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HOUSE AND HOME

BY

GRETA GRAY, PH.D.

EDITED BY

BENJAMIN R. ANDREWS, PH.D.

"Interior," painting by the Danish artist J. Shlichtkrull

HOME IS WHERE THE HEART IS

HOUSE AND HOME

A MANUAL AND TEXTBOOK OF PRACTICAL HOUSE PLANNING

By

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WITH AN ARTICLE BY

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196 ILLUSTRATIONS IN TEXT

THIRD EDITION, REVISED

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PREFACE TO THE THIRD EDITION

More than a decade of increasing national, community, and individual interest in housing problems and of steady progress toward comfort and convenience in housing has passed since this book was first published. The prospective home-owner or renter now finds available a wider variety of labor-saving devices, better lighting, superior heating and air-conditioning equipment and plumbing fixtures, and plans leading more directly to the ends of comfort, safety, and beauty in the home. In architecture, the revolt against the tyranny of inherited architectural forms has reached larger proportions and there is a greater tendency to experiment. The student of housing must now take note of Federal and other governmental housing projects. These projects comprise a many-fronted attack upon slums, and they have given impetus to constructive housing programs which will undoubtedly result in still greater improvement in the dwellings of people of all economic groups.

Intelligent interest in these matters and an understanding of the fundamentals of good housing will hasten progress. In taking account of recent changes in the housing situation, this third edition will, it is hoped, be of service to this end.

INTRODUCTION

A Complex Problem.—Shelter, like food and clothing, is one of our fundamental needs. There are many problems, sanitary, economic, social and architectural, involved in a consideration of shelter. This volume deals with these four phases in an elementary and non-technical way, and it is hoped that it will lead those who use it to study the subject further for themselves.

Many of the problems of sanitation of the house are housekeeping problems, many in cities are municipal, others are the householder's. In the country the householder has more sanitary problems than the city dweller has. It is the sanitary problems of the householder, rather than those of the community, or of the house-keeper, of which this text treats.

Some of the economic problems are those which every household must deal with, carfare, service, rent, or interest on investment, insurance and so forth. Social problems, such as education and the social status of the family, are involved in the location of the house and therefore they receive brief mention. There are other economic and social problems that have to do with shelter which affect the community as a whole as well as individuals and which must be dealt with by the municipality or the state. The housing of wage-earners, town planning and the securing of capital at low interest rates for house building are some of these. We should each of us realize his responsibility in these matters and any study of shelter should include them, for the student should have a broader aim than merely that of finding and securing the best for his own home. Both American and foreign critics have been in the habit of telling us that our buildings are as a rule destitute of beauty, and it must be admitted in spite of many noteworthy exceptions that until recent years the criticism has been just. Even people who are untrained in the principles of beauty perceive that many of our houses and public buildings are unsatisfactory as to exterior effect, yet these people when they build are likely to erect structures just as uninteresting and uninviting as those they criticise. Why is it that we do not have more beautiful buildings? Some tell us it is because we do not employ an architect when we are ready to build, but take our plans from a book or let a contractor give us some stock plan of his own which comes near to matching our ideas and pocket-books; they say that a competent architect would do better for us. Doubtless a competent architect could, but many persons call themselves architects who are not competent, and the competent architects are likely to be so busy with larger works that they do not care to undertake what they call a small house, a house which costs up to twenty thousand dollars, and most of us cannot hope to build a twenty thousand dollar house. Smaller houses costing from three to fifteen thousand dollars often cost the architect more than the fee he receives, even when that is ten per cent. of the cost of the house, if he gives them the attention necessary to satisfy his client and to see that his plans and specifications are carried out. For houses costing even less than this an architect can seldom be employed unless he is engaged to plan a number of them at one time.

Necessity for Study.—The less one can spend on a house the more essential it is to plan carefully to get all that can be had for the money available. If people who are about to build could work out on paper their own ideas and know that they were feasible, and if they had a basis for correctly evaluating the matters which must be considered in building, and would then go to an architect with their sketches and ideas, the architect would have an easier task, and the house would be in better taste. Selection of plans from a book or giving over sketches to a contractor would not be so unsatisfactory if the owners knew how to choose wisely and if they knew what stipulations to make in a contract. Another solution of the problem may be found in the new movement toward building houses in wholesale numbers. A competent architect can afford to undertake a suburban development of one hundred houses for one firm to be put up at one time when he cannot afford to undertake one hundred different houses for different owners at different times. As a people we must be trained in the laws of beauty and design, and in the application of these rules, and then we may hope that all of our buildings may be beautiful. Our public schools are beginning to do good work in this direction.

This book is designed as a text for students and for the members of study groups, and it is hoped that it may be interesting to the general reader and a help to all those people not architecturally trained who look forward to the day when they may buy or build their own homes. It is meant, however, not only to assist those who may buy or build, but to guide people in the selection of rented places, so they may help to create a demand for dwellings that shall be beautiful, comfortable and safe. Another end which the writer trusts it may serve is to arouse interest in community housing problems and in city planning. The book is not designed to make architects or town planners of the students who may use it, but it is hoped that it may make them intelligent about many matters pertaining to the house and its environs.

The problems at the end of each chapter are placed there for the purpose of showing the reader how to apply the facts stated, or to set tasks the doing of which will bring understanding of the points studied. There is one set of connected problems pertaining to the planning and building of a home which runs through the text and which is planned to bring out the important points to be considered in selecting a house, and to establish ideals of what a house should be.

THE AUTHOR.

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HOUSE AND HOME

CHAPTER I

THE HOME AND THE HOUSE

"East, west, hame's best."

Home.—A dugout on the plain or one room in a city tenement may contain more of home than the neat suburban bungalow or the spacious apartment on Riverside Drive, for home is something belonging to the heart, it means human companionship, shared love and joy and sorrow. The places we call home are those where we have had such experiences, or are now having them. They may even be airy Spanish castles in which we hope to have them. Home is not a house, nor a place, nor furnishings, but it is the hopes and memories which cling about "the place of habitual abode." We make a home in a certain place, among material things, but not of materials.

Relation Between House and Home.—The house and its surroundings are intimately connected with the home, each modifies the other. Hawthorne's *House of Seven Gables,* Poe's *Fall of the House of Usher,* the reports of investigations of housing committees, vital statistics, all tell us the same story. The dwellers in a house put their stamp upon it, even when they have left it empty it reflects something of their characters and habits from its walls and floors, from the very air which has surrounded them. Still more the house modifies the home and the people who dwell in it. Disease and death come more frequently to the damp, unventilated house than to the sunlit one. The inconvenient house, making irksome the necessary work, influences the dispositions of all under its roof. The quiet, dignified house with a beautiful outlook brings soothing and inspiration.

The home is a complex, built up of the emotions of the members of the family, depending upon their characters and their experiences. But character and experience are shaped largely by environment, both physical and spiritual. The houses we live in are intimate parts of our physical environment, their locations still further determine physical environment, and, more important *still, the house and its location to a large extent determine spiritual environment, through the influence they have upon the choice of friends and intercourse with them.*

In large cities it is true people know little about their neighbors and families often live side by side without becoming acquainted, but in small places and in suburban communities one's circle of acquaintances depends largely upon the location of one's home. Then, too, the advantages afforded by schools, churches, libraries, museums and parks in our neighborhood have an incalculable influence upon the development of our higher nature.

The house is all-important in moulding our lives and its selection demands careful study. We should have house standards, know what is essential, and what we can do without. We have food standards, we have some attempts at standardized dress for women as well as for men, and we should formulate certain minimum standards of housing and have an understanding of the best way in which money beyond the amount required to reach the standard, may be spent on the house to add to the pleasure and satisfaction of those who live within it.

Uses of the House.—There are two considerations of prime importance which should influence every decision made in connection with the selection of a house. First, the primary use of a house is for protection, it is what we put between us and the world, our shell, analogous to the shell of the snail or that of the oyster. Second, the house is our base, the point from which we make our contacts with the world, the place where we recover from our daily struggles and prepare for them, the place from which we set forth for adventure or pleasure, it is like a naval station where ships are repaired and where they get their supplies, and as with ships and their bases, the distance which we can put between ourselves and our houses is limited. We should then consider in the planning or choosing of the house, its structure, sanitation and arrangement, also its location and general adaptability to our physical and social needs.

The original purpose of the house was protection from the elements, wild beasts, and hostile men, and the first houses were caves and tree houses. Protection is still the basic purpose of the house, but now, besides these primitively known and feared dangers, we realize that there are a host of others from which our houses should shelter us, disease and the agencies of its transmission, fatigue and strain, which may be in some measure avoided by well-thought-out arrangements, mental depression which cheerless surroundings and lack of sunshine frequently induce, and others equally as important, perhaps, but less tangible.

Each member of the household returns home at night to find recreation and rest and quiet. At home he receives his friends, and frequently the choice of friends is limited to those who live in the same neighborhood. Any house should be a place where each member of the family may find quiet and rest, recreation and opportunity to achieve the maximum efficiency and happiness. A typical family consists of father and mother and children, frequently a third generation is represented by a grandmother or a grandfather, and there are older people, young people and children for whom provisions must be made. Besides the family group some households have employees, and all families at times entertain guests, so there are three distinct groups to be considered in planning a house, the family, employees, and guests. The house should have rooms where the whole family may gather together and meet their friends, to enjoy music, books and pictures; rooms for rest and privacy, places where each member of the household may be safe from intrusion, to sleep or work or think; and rooms for carrying on the work required for the physical needs of the family. The number of rooms of each kind required will vary according to the family and its habits and tastes. These different sets of rooms must be grouped together and connected by halls and stairways, all under one roof.

Our choice of a house, as all our choices are, is limited. In the case of the choice of house the greatest limitation is the economic one, again the occupations of the income-earning members of the family limit the choice of location.

In the following chapters we shall consider from the standpoints of sanitation, cost, social advantages, and æsthetic aspects, the location of the house, its site, house plans, heating, plumbing, lighting, conveniences and labor-saving devices, beauty and materials. We shall also discuss the problems of the country house, the apartment house, community housing problems and the pros and cons of owning *versus* renting.

PROBLEMS

1. Can you from your own knowledge give an illustration of the influence of the house on the family or on some one member of the family?
2. *What purposes should the homes of the following serve:* Governor, *teacher, janitor, farmer, clergyman, merchant?*
3. What are the reasons for the generally accepted idea that a hotel does not provide a favorable atmosphere for home-making?
4. What apartments are necessary for an American home?
5. List the rooms of the ordinary detached one-family house and note the relation of each to individual life, to family group life, to health, to hospitality.
6. List the different types of house (*i.e.*, village house, apartment, etc.) which you know, and explain what seem to be advantages or disadvantages of each in securing a sound family life.
7. Do you prefer a one-story or a two-story house? Why? Were you thinking of ease in doing work? Ease in caring for children or the sick? Privacy? Security? Appearance of interior? Of exterior? Ground space?
8. Does "home" mean the same to different people, for example, to the little child, to a man, to a woman, to a young couple starting housekeeping, to the same couple on their fortieth wedding anniversary?
9. What are the differences in the "home feelings" a person has toward different houses, *i.e.*, the house he lived in as a child, his grandmother's house where he spent vacations as a child, the houses he has occupied in adult years, his parents' house as he visited it after having acquired a home of his own, his son's or his daughter's house?
10. What do you consider the most important need which your own house should fulfil?

CHAPTER II

LOCATION

From all four of our viewpoints, sanitary, economic, social, and æsthetic, the choice of location is of paramount importance and many details that we shall study later will be found dependent to a certain extent upon location.

Soil.—The kind of soil on which a house is built affects the health of the dwellers in that house. The soil should be dry, well drained and unpolluted, with the ground water level well below the foundation. Sand, and sandy loam consisting of sand and clay are very good soils on which to build. Made ground, marshy land, clay and marls, are poor soils for a house. Damp soils are injurious to health, containing more bacteria than dry soils, and predisposing people to certain diseases. It is extremely difficult and expensive to build a dry house on poorly drained ground, it is also difficult to make a good lawn on such ground. Soil which has been polluted by sewage, by decaying animal or vegetable matter, either on the surface or buried, or by leaking gas pipes, is undesirable. Pathogenic bacteria from the sewage and refuse may be carried in many ways from the soil to a point of entrance into the body. Children playing on such ground are especially liable to infection through cuts, or by putting contaminated objects into their mouths. Injurious gases are carried by currents of ground air into the house or into the air surrounding it.

Sun and Ventilation.—Other essentials for a healthful site are plenty of sunshine and freely circulating air. Sunlight is inimical to the growth of bacteria, it is a disinfectant, and freely moving air insures the carrying away and final destruction of the impurities which collect wherever there are animal beings throwing them off from their lungs and skins, or by their activities rubbing them off from their tools and clothing or manufacturing them by their fires. All of these impurities if they accumulate, seriously interfere with health, but when scattered they are rendered harmless, some, such as carbon dioxide from the lungs or from fires, being used by plants to build up their tissues, others disintegrating and enriching the soil.

In order to secure these three things, well-drained soil, sunlight and fresh air, it is well to choose a site which rises above its surroundings (although this is not always necessary) and one which is not too much shaded by trees or cliffs or buildings.

Prevailing Wind.—The direction of the prevailing winds of the locality is another important consideration in choosing a site for a house. This should be chosen so that these winds sweep over it fresh from the country, the sea or the mountains, before they have passed over the smoky, dirty city, in order that they will not bring with them soot and gases, refuse and bad odors. A site near a place from which disagreeable odors emanate, such as a barn or a slaughter house, is not a desirable site. Even though the offensive odors do not directly injure the health, they may do so indirectly, through their influence on the nervous system. Smoke and dust from manufacturing plants may be decidedly injurious, and

John T. Allen, Hollywood, Cal.

FIG. 1.—A pleasant site. Presumably the house is sheltered from the wind by the hill, and a fine outlook away from the hill is suggested by the arrangement of the main mass and the wings. Good design is shown in the way the house fits the site.

excessive noise frequently gives rise to physical disturbances of different kinds.

Outlook.—*A beautiful view is always an asset, and that house has an incalculable advantage the windows of which overlook a river, a lake, or the ocean, or command a view of broad prairies, or give a glimpse of hills or mountains, or look down upon the streets of the city spread out like a map and outlined at night* by twinkling lights. Fine old trees or trees of any kind and shrubbery add immensely to the value of a lot.

FIG. 2.—The charm of this lot lies in its elevation and gentle slope, the trees and shrubbery, which seem to be wild, and the background of foliage. The simple and frank design and good proportions of this house make a very pleasing structure.

Water.—A desirable site must have a constant, unlimited supply of pure water at hand, an artesian well perhaps in the country, healthful city water in town. In the city the problem of sewer connection must be considered.

Gas and Electricity.—These are great conveniences and their availability should be considered in selecting a home site in the suburbs or in the country.

Points of the Compass.—A minor point to be considered is whether in going to work or school in the morning and returning to the house in the evening one must face the rising and then the setting sun. The blinding and scorching rays are disagreeable and nerve racking, even though we may appreciate to the full the beauties of sunrise, and the glories of sunset, when sufficient clouds form a protection from the glare.

Distance to Business.—A family must live within reasonable distance of the place where the head of the family works. He must make the trip to the shop, or the office, each morning, and back home again at night. He may walk, or take a street car, as the majority of city men do, commute, perhaps with a ride or walk at either end, drive his car, or possibly go to the city in his yacht, as some fortunate individuals do, soon he may go back and forth by aeroplane. The distance a man may live from his place of business varies with the means of transportation, for too much time must not be taken up by travel. If more than one member of the family works away from home this matter of location in regard to place of work and means of transportation must be considered for each case.

Accessibility to Church, School, etc.—When there are children in a family the home should be located near a desirable school unless there is some dependable way of getting them to such a school at a distance. Any school will not do, unfortunately, and parents should send their children to a school where sanitation is all that can be wished, where they will form desirable acquaintances and where they will receive good teaching. Accessibility to the church and Sunday-school of one's choice, to libraries, parks, and museums, are other items to be considered.

Besides these concrete matters, associations are to be thought of. Will the other families in the neighborhood be congenial and friendly? Are they people of one's own age or do they belong to an older or a younger generation? Will the children as they grow up be making the right kind of friendships, will they have before them during childhood and youth homes with the right ideals, men and women whom it would be well for them to imitate? Will they learn by example, in the community, the lessons of good citizenship, of coöperation, of tolerance, of the helping hand?

Often one's preference as to dwelling, whether it shall be a single house, or an apartment, limits the choice of location, and *vice versa.* Sometimes one must take what one can get in order to live in the locality decided upon.

Building Restrictions.—The building restrictions in any district deserve careful consideration and should be studied for the whole neighborhood as well as for the lot the purchase of which is being debated. One should know exactly what these restrictions are and for how long a period they are to apply. In many new subdivisions there is a communal ownership of, and consequent responsibility for the roadway, in many ways an advantage, but entailing obligations which the purchaser of a building site should understand.

Size and Contour of the Lot.—The topography of the lot should be studied. Will it be possible to build on it the type of house desired? Ground sloping from the rear to the front means a high foundation in the front, giving a tall, narrow appearance to the house, and may mean also that it will be difficult to find a suitable place for the laundry. On the other hand, ground sloping to the rear or to one side is often a distinct advantage.

Cost.—There is one other very potent factor which enters into the choice of location, that is the amount of money which can be paid for the place either as rent or for purchase. In comparing the cost of houses in different locations one should add to the rent (or to the taxes, insurance, interest, etc., on owned places) the monthly total of car fare for all members of the family, for this varies. Luncheons away from home made necessary by the distance to business, school and shopping are virtually additions to the rent. The cost of light, gas, fuel, water, necessary help, may vary considerably between two places, and the cost of food is another item which frequently varies widely in neighboring communities. If one place permits of a vegetable garden, and another does not, and if the labor expended in the garden may be counted as paid for in the exercise and pleasure it gives, this reduces the cost of the first place. Decreased danger of disease may be counted as reducing the cost of a place by the average amount per year that the family saves in doctor bills and time which would otherwise be lost in illness, not to mention the mental agony avoided by the lessened amount of illness. In selecting a lot one must consider, in addition to price, taxes, and assessments for improvements already made or which must eventually be made. The cost of building on any particular site must also be calculated. It varies with the amount of grading required, kind of soil and accessibility of building materials. Another thing to consider is the lot as an investment. Will it be likely to increase in value, or may it decrease? Even when one is not building for an investment this matter should be taken into account.

Relation of Lot to Desired House.—Before purchasing a lot it is well to consult an architect about it, and to give him an idea of the type of house it is desired to put on the lot. He may be able to give valuable counsel as to the advisability of the purchase in the light of his professional knowledge and of the client's desires.

We see that the choice of location must be determined by many things, it should be in a neighborhood that will be favorable to good health, it must be where those whose activities take them away from it can go back and forth easily, it should be where opportunities for development of the higher life are within reach, where occupation, entertainment and desirable companionship for leisure hours may be found for all members of the family. The final limiting factor of our choice is the amount of money we can afford to pay.

PROBLEMS

1. In your town what is the most desirable section in which to live? Why?
2. In selecting a lot on which to build, would you prefer it in a part of town well built up with good houses, or in a new addition with no houses? Why?
3. What do you consider desirable restrictions for a city's suburban residence section? For a village of less than one thousand?
4. If streets run due east and west and north and south in your town, which streets do you think offer the best residence sites? Why?
5. What are the advantages and disadvantages of lots on opposite sides of a street running north and south and cut into the side of a hill, the upper side of the hill being on the east and the lower on the west?
6. Make a list of five debatable topics in regard to location.
7. What are disadvantages as to location of the house you are now living in?
8. Make out a score card for lots in your town.
9. Find an ideal site for a house for your family. If possible find out the price of this site.

*10. Find a lot as near your ideal as possible, to cost not more than from three-tenths to five-tenths of your family's annual income.

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* The starred problems are those of a connected set running through the book.

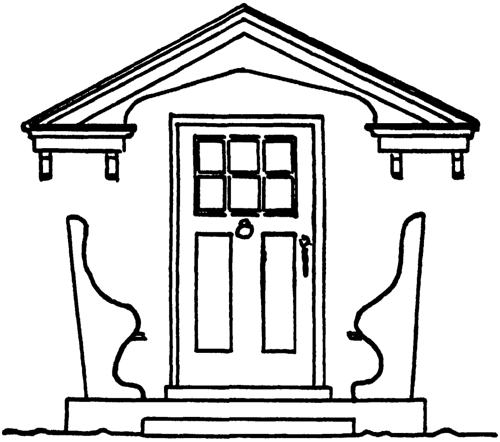
CHAPTER III

PLANS

The plans for a house consist of floor plans, roof plan, elevations of the exterior, and detail drawings of parts of the house such as fireplaces, built-in cupboards, doors perhaps, and other parts which need to be drawn out on a large scale. The floor plans and elevations are usually made to the quarter scale, that is, one-fourth inch on the drawing represents one foot of the real house. Preliminary studies, by which the arrangement of rooms is worked out, are usually made to the eighth scale, that is, one-eighth inch equals one foot. Drawings of some of the details are made full size. All these drawings are sometimes called "the plans." The "plan," however, is the floor plan, showing the arrangement of the rooms. A cottage all on one floor will have one floor plan; for a larger house, there will have to be first-floor plan, second-floor plan, basement plan, and attic plan.

Elevations.—The elevations are conventional drawings of the exterior or of parts of the interior (Fig. 3). In looking at a house we see things in perspective, we can gauge the depth of a door or window because we see one side at least of the jamb. In making the drawings of the elevations they are drawn as if the different surfaces were projected back against a plane surface, as if the thickness were taken away, that is, the elevations show but two dimensions, height and width. The plan also shows but two dimensions, width and depth. The depth must be determined from the plan, the height shows only on elevation. Sometimes a perspective drawing is made, to show how the house will really appear to the eyes of the beholder, for unless one has worked for a long time with elevations and seen them built one cannot tell by the elevation much about the actual appearance of the house. The making of perspective drawings cannot be dealt with in this little book.

Floor Plans.—A floor plan shows all of the openings, doors, windows, archways, fireplaces, stairways, porches, steps and roof surfaces which are on that floor level. The floor plan may be likened to what would be seen if one were to cut through the house parallel to the floor at a distance above the floor that would strike the window openings. This would show the thickness of the walls. When such an imaginary section goes through solid walls or fireplaces that area of the section of wall or fireplace is blacked in,



ELEVATION

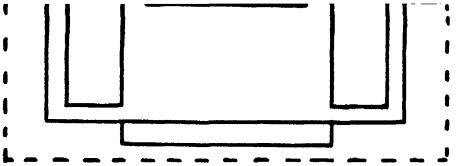


FIG. 3.—Plan and elevation of an entrance.

sometimes cross-hatching being used to indicate brick or stone and the blacked-in part indicating wooden walls. To show windows the outside lines of the walls are carried through and one line, or sometimes two, is drawn half-way between them and parallel to them to indicate each window. Often on a small scale no lines are drawn for windows. Sometimes the doors are shown as straight lines making slight angles with the walls to show which way they swing open. Wall lines are not continued through the door spaces except the outer wall line of an outside door. The plan is made with everything shown on it drawn to scale (Fig. 5). Sometimes something which would not show on the plan because it is above the imaginary section line is drawn in dotted, for instance, the mantel shelf or some of the steps of the stairway or something in the ceiling, beams or a trap door to the attic. Dotted lines are also used to indicate something under the floor, steps, for instance, on the floor below. Other things shown on the plans are plumbing and heating fixtures, and electric light and power outlets and switches. The first are easily recognized, the latter are usually labeled, and the connections between lights and switches drawn in colored, faint, or dotted lines.

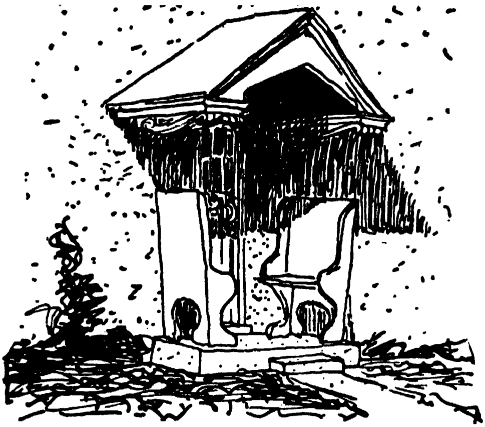


FIG. 4.—Perspective view of the same entrance

Dimensions of Walls and Openings.—Inside walls of ordinary construction are six inches thick, a wall for a sliding door ten inches, outside walls of frame are six inches thick, and of brick eight or twelve inches. Doorways vary greatly in width from the great archway to a closet door. The ordinary door is about two feet eight inches to three feet two inches wide, closet doors are *smaller, the entrance door may be from three feet six inches to four feet or more in width.* Door openings for sliding doors and archways vary from four feet wide to six feet or eight feet or more. The ordinary double door opening is five feet in width. Windows vary also, the ordinary window opening is about two feet six inches wide by six feet in height. The size of a window should depend upon the climate, and upon the height, size and use of room, width of street or space between buildings, the height of opposite buildings, and the kind of glass used. The ordinary window is a double-hung sash. We have also casement windows, swinging open on hinges like doors, pivot windows which revolve on one of their axes, and French windows which in reality are glazed double doors.

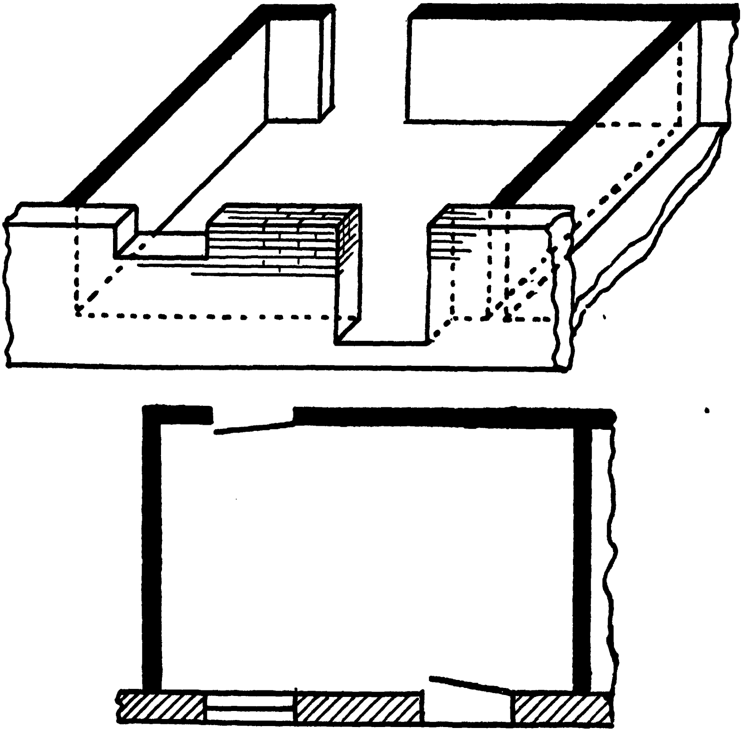


Fig. 5.—Section of room and plan.

Dimensions of Fireplace and Chimney Breast.—The size of a fireplace depends upon the size of the room in which it is built and upon the fuel to be used. The chief function of a fireplace is presumably to heat a room and it should be large enough to look and to be adequate for this purpose. Secondly, the fireplace is an ornamental feature, a centre of interest, and it should be sufficiently in evidence by reason of its size or ornamentation to fulfil this function.

For the average room the chimney breast projection containing the fireplace is five feet six inches to seven feet wide and the shelf is placed at a height of four feet six inches. The fireplace opening is made about three feet wide and is placed in the centre of the chimney breast. If cord wood is burned, the width of the fireplace opening should be four feet six inches. The height of the fireplace opening is usually between twenty and thirty inches and one should remember that the lower the opening the better the draft. The hearth is made as wide as the chimney and about twenty inches deep. The depth of the fireplace opening is from sixteen to twenty-two inches and there should be behind it twelve inches of brick and lining. This makes the overall depth of the chimney breast from twenty-eight to thirty inches without finishing. The chimney breast may be flush with the wall on the outside of the house, making it project into the room of a frame building from twenty-two to twenty-eight inches, or it may extend beyond it, making the projection into the room less or even nothing at all. The usual projection is from twelve to eighteen inches.

Dimensions of Flues.—In making our plans we are concerned with the size of the flue, for this must be carried from the fireplace up through other floors to the roof. The flue should be made so that its area will be one-tenth that of the area of the fireplace opening. With a fireplace opening three feet wide by twenty-five inches high we have an area of thirty-six by twenty-five inches, or nine hundred square inches, the flue area should be about ninety square inches, or eight by twelve inches, which is the area of the standard size fireplace flue. This eight-by-twelve-inch opening must be surrounded on all sides by eight inches of brick work and carried to the roof. A furnace flue in a medium size house is twelve by twelve inches and this is often, when there is a fireplace, carried up through the first floor in the chimney breast, where it must have eight inches of brick work around it except next to the fireplace flue, where four inches are sufficient, and then through the second floor with the fireplace flue. When two or more flues are carried to the roof together (and it is always a good plan to do this if possible, for it saves expense and is more attractive in appearance), four inches of brick work or lining must separate the flues from each other. The best draft is secured when a flue is carried in a straight line to the roof, but when it is desirable it may be sloped slightly in one direction, so that on the floor above its starting place it may be three or four feet to one side of its starting place.

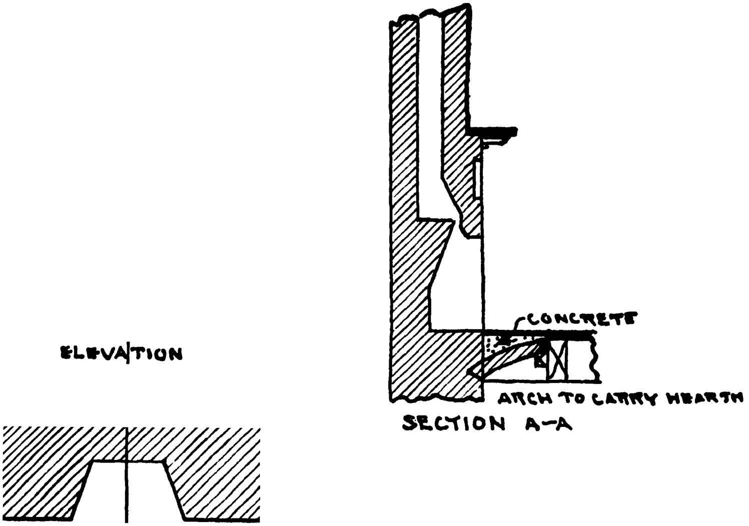


FIG. 6.—Plan, elevation and section of fireplace.

A fireplace with its chimney breast must be supported, and it is usual to build it up from the basement floor, so we have the same dimensions for the chimney breast in the basement that we have on the floor where the fireplace opening is (Fig. 6).

Dimensions of Stairs and Stair Problem.—The dimensions of stairways vary with the size of the house, and with the importance of the stairway itself. The usual width of the stairway in a small house is from three to four feet. A cellar stair or a back stair may be two feet six inches or eight inches wide. In stair planning we must consider the fact that furniture must be moved in and out of the house and up and down the stairs. Stair planning is probably the most difficult technical problem we have to deal with, and stair building is reckoned a trade in itself. Stairs are designed to allow us to walk comfortably from one floor of a building to the next. To secure this easy ascent it is necessary to calculate very carefully the amount of space needed for the stairway. The first thing to do is to determine the distance between the two floors which the stairway is to connect. This is the distance from the first floor to the ceiling plus the distance between the ceiling and the second floor. Many amateurs make the mistake of considering only ceiling height, but to this must be added about fourteen inches, more for large buildings, less, or about twelve inches, for small buildings, the depth of the second-floor joists and the thickness of the floor and ceiling finish; this latter item accounting for two inches of the distance between the ceiling of the first floor and the floor line of the second. The number of steps needed is determined by this dimension.

The two principal parts of a step are the riser and the tread. The riser is the vertical portion of the step, the tread is the horizontal part, the part we tread on. The height of the riser and the width of the tread vary greatly. Monumental stairways have broad treads and low risers, a little back stair may have the riser higher than the tread is wide. Neither of these stairways is a comfortable one to climb. A riser of from six and one-half to seven and one-half inches is more comfortable for the average stair-climbing individual, although we can become accustomed to higher or lower risers when necessity or appearance calls for them. There is a certain relation between the riser and the tread, the lower the riser the wider the tread must be, and the higher the riser the narrower the tread, in order to accommodate the average person's stride, so we have the following formula which expresses the relation which the two must have toward each other: $2\ R + T = 25''$, that is, twice the height of the riser plus the width of the tread should equal twenty-five inches. In order to determine the number of risers needed, take the number of inches between the first and second floor lines and divide this number by seven. This gives the number of seven-inch risers required to get to the second floor. This number usually is a whole number and a fraction, so since we do not want a part of a riser we divide the number of inches between the two floors by the whole number, or the whole number plus one, the number of risers we shall use, and this will give us the height of each riser in inches. For example: The distance from floor to ceiling is nine feet six inches, one hundred and fourteen inches, the thickness of the second floor is fourteen inches, this gives us one hundred and twenty-eight inches to get up. One

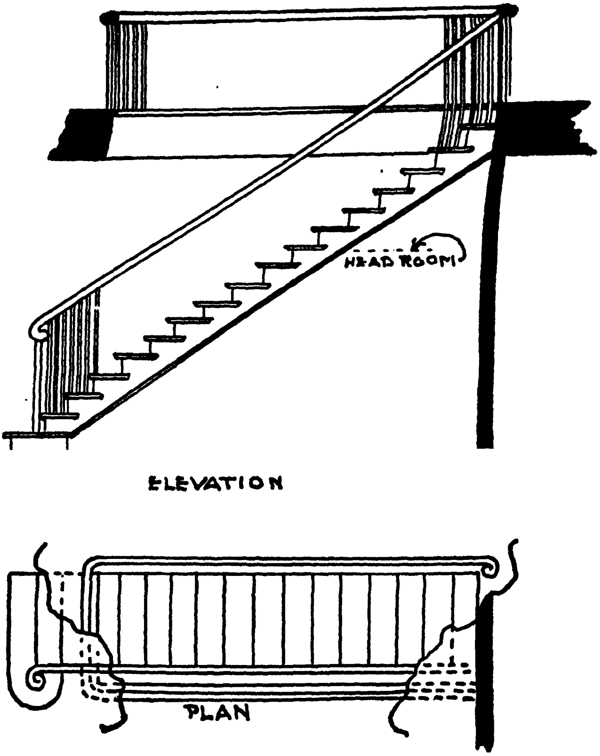


FIG. 7.—Stairway of one run. Plan shows well hole with part of upper floor broken away as indicated by jagged lines. The broken away part of upper floor is shown by dotted lines. Full lines to right and left of jagged lines show features on first floor.

hundred twenty-eight divided by seven gives us eighteen and two-fifths, the number of seven-inch risers we would need, but since we do not want a fractional riser we will use eighteen risers. To get the height of the riser we divide one hundred twenty-eight inches by eighteen, which equals seven and one-ninth inches, the riser height. To find the appropriate width of tread we use our formula $2R + T = 25''$; therefore, $T = 25'' - 2R$, in this case $25'' - (2 \text{ x } 7\,{}^1\!/_9{}'')$ or $25'' - 14\,{}^2\!/_9{}''$ or $10\,{}^7\!/_9{}''$, which we may call ten and two-thirds inches, the width of the tread. We might in this case use seventeen risers instead of eighteen, this would make the height of each riser seven and nine-seventeenths inches, which is not bad. The tread is the distance between two risers, therefore with any number of risers we shall have one tread less than the number of risers. In this case we have seventeen treads. Seventeen treads of ten and two-thirds inches equals one hundred eighty-one and one-third inches or fifteen feet one and one-third inches, the horizontal distance we will have to travel in going from one floor to the next. If this is all in one run our plan and elevation of the stair will be as shown in the accompanying sketch (Fig. 7).

The next point to determine is at what point we can get under this run of stairs, that is, where will the risers have reached a height which gives us head room beneath them. Stairs have thickness, and this is usually measured perpendicularly down from the front edge of the tread and is about fourteen inches. Allowing six feet six inches for head room, enough for everyone, except the unusually tall, we must get up six feet six inches, plus fourteen inches, or seven feet eight inches or ninety-two inches to have head room underneath. With seven and one-ninth-inch risers this is thirteen risers. So under the tread following the thirteenth riser we will have head room. With higher treads and steeper stairs we would have head room under the twelfth or the eleventh or the tenth riser. Sometimes less than six feet six inches is allowed for head room, and where appearance counts, more than this should be allowed. When the distance above the floor at which a landing with head room under is to be determined, we do not need to allow fourteen inches for the distance below the landing floor to the ceiling under the landing, eight inches is enough. This is because the thickness of the landing is less than the distance between a tread and the surface under it when this is measured perpendicularly from the front edge of the tread, as may be seen in the accompanying sketches.

There is another stair matter which it is difficult sometimes for the amateur to understand. We can go up a few steps with the ceiling over our heads, but there comes a point where we would bump our heads against the ceiling, if there were not an opening, the well hole, in the floor above us. How large must this well hole be? If we have determined the number of steps up we must have to get head room underneath the stairs, we know that the same number of steps down from the second floor will carry us to the point where we will have head room under the first-floor ceiling, and that the opening in the second floor must extend at least over this number of risers, counting from the top step.

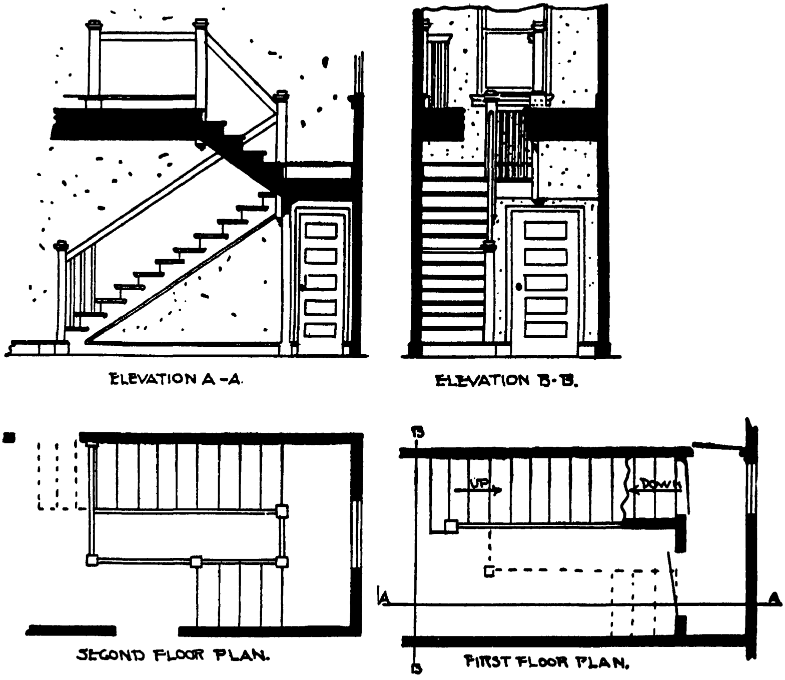


FIG. 8.—Plans and elevations of stairway with two runs. A passage under landing and stairs going down under the first run, shown on the first-floor plan.

Because in coming down stairs, we sometimes throw ourselves forward, as it were, we should extend the well hole over another step, and since steps must be used for moving trunks and furniture up and down there is less danger of damage when the well is made even larger than this (Fig. 8).

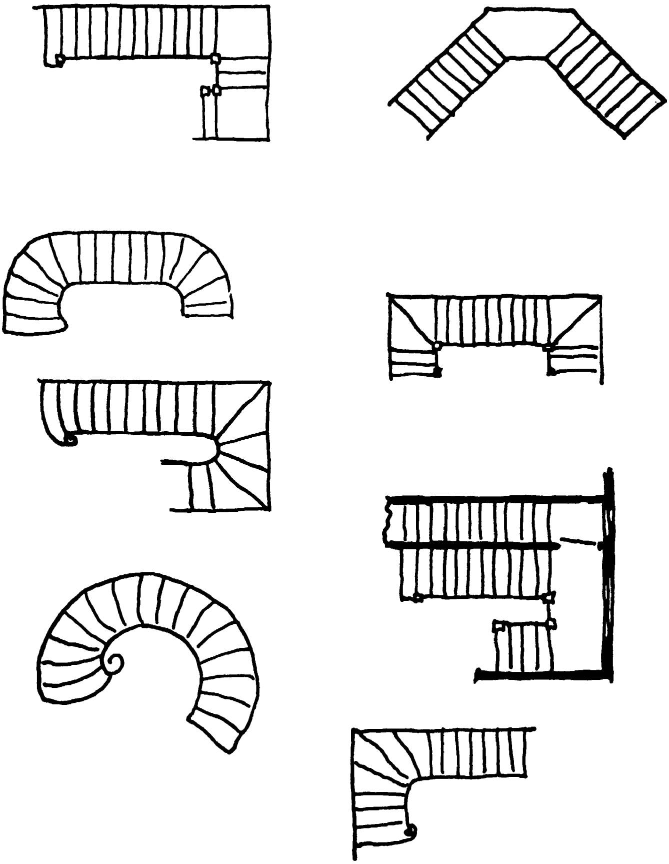


Fig. 9.—Stairs of various plans.

Stair Plans.—Stairs are not usually built with one straight run from bottom to top. Usually there is a landing or two, breaking the flight into two or more runs. This makes a more convenient plan, besides, such stairs affording resting places are more easy to climb. *Stairs are sometimes built in angles, or around curves, part, or all, of the way.*

"Winders," that is, steps the risers of which are not parallel with other risers, should be avoided if possible. They are often found replacing the landing platform which would otherwise be found between two runs of steps making an angle with each other, and are used to save space. We also find winders in curved or circular stairways. If winders must be used, the wedge-shaped treads should not run to a point, for this makes the tread too narrow where persons step. The width of the tread at this point (where people step), about four inches from the handrail, should be as nearly as possible that of the other treads, therefore steps around a turn should be planned with truncated treads. This is done by making the risers radiate from a point a foot beyond the apex of the angle which would be formed by the intersections of the inner boundary lines of the two runs of stairs which are connected by the winders, as is shown in the sketch (Fig. 9). When a stair turns so that one run carries one exactly in the opposite direction of another run, a space of one foot at least should be left between the two runs, unless there is a wall between the two, in which case the width of the wall is sufficient. It is always an economy in the use of space to put one stairway under another. A combined front and rear stairway also saves room. The first runs of the front and rear stairs reach the same platform, and from this point there is just one flight to the second floor. On the landing there should be a door to shut off the rear stair from the front stair.

Other points to remember in connection with stair planning are that stairways should be well lighted and that there should never be less than two steps in a run, because a single step may cause one to stumble and fall.

PROBLEMS

1. Make a plan to eighth scale of a room twelve feet by fifteen feet with walls six inches thick. In the centre of one long wall show a door three feet wide opening from a stoop four feet square which has two steps to the ground. On either side of this door, in the centre of the remaining wall spaces, show a window two feet eight inches wide. In one of the side walls show a door two feet ten inches wide opening into another room.

2. Draw the plan of your bedroom to eighth scale.
3. Get the measurements of the following pieces of furniture: Piano, (a) grand, and (b) upright, davenport, sectional bookcase, library table, straight chair, rocker, large upholstered chair or wicker chair, sideboard, sewing table, dining table, china case, dresser, bed, (a) single, (b) double, and (c) child's. Make notes as to whether these are large, small, or of medium size. Draw in to scale the furniture of your bedroom on the bedroom plan you have made.
4. Measure the living rooms in the house in which you live, also certain rooms which please you as to size and shape. Measure up doors, doorways and windows of the living rooms in the house in which you live or others which you like. Measure one or two fireplaces, (a) width of fireplace opening, (b) height of opening, (c) width of chimney breast, (d) height of shelf, if any. Measure one or two stairways, (a) height of handrail, (b) width of stairway, (c) height of each step (riser), (d) width of each step (tread), (e) dimensions of landings, (f) number of risers, (g) distance between floor and ceiling, (h) distance between floor and floor.
5. Draw a plan of a fireplace with dimensions as follows: The chimney breast five feet six inches wide; the fireplace opening two feet six inches wide and sixteen inches deep. Show the fireplace projecting into the room twelve inches. What size would the flue need to be? Draw plan of this flue as it would appear on the floor above.
6. Make a plan for a fireplace of the same size but with chimney breast built to contain a twelve-by-twelve furnace flue. Draw the two flues as they would appear on the floor above. Draw the elevations of this chimney breast and fireplace.
7. Plan a stairway for a house with the first-floor ceiling height eight feet six inches with ten-inch second-floor joists. Have a landing at the lowest point which will permit of a lavatory below it.
8. Draw the front and side elevations of this stairway.
9. Measure some exterior feature, entrance, porch or the whole façade of a small house and draw the elevation.
10. If possible get a set of working drawings for a small house and study out the meaning of each line.

CHAPTER IV

HOUSE PLANNING

> “When we mean to build
> We first survey the plot, then draw the model,
> And when we see the figure of the house
> Then must we note the cost of the erection
> Which if we find outweighs ability
> What do we then but draw anew the model
> In fewer offices, or at least desist to build at all.”
>
> —HENRY IV.

We will study this topic from the point of view of the family building a house to suit its needs, bringing out the principles which should govern the placing of the house on the lot and the arrangement of the rooms. This will give a basis for the judging of house plans, on paper, or builded.

Variety of Rooms.—There are three types of apartments under any house roof: (1) Public rooms, those where visitors are received and where the family gathers; (2) private rooms, sleeping and dressing apartments, private studies perhaps; and (3) work rooms where household operations are carried on, kitchen, laundry, and furnace rooms. It is true that in the crowded house two or more of these processes may be served by the same space, but in such a house as we would adopt as a standard, the rooms would be separated for sanitary and for æsthetic reasons. It is natural to place all the public rooms together, to keep the work rooms out of sight, and to group the bedrooms. In the planning of each of the divisions of the house certain general rules hold, although details of plan must be worked out for each house according to the client’s desires, the cost limit, and the location.

General Conditions to Which Plan Must Conform.—A house must be planned to meet the requirements of the family for which it is designed, and according to the limitations of the lot. It practically never happens that a plan used for one family on a certain lot fills the needs and fulfils the desires of another family with a different building site. Nevertheless, in building, the owner should bear in mind that he will not always live in the house, he may move, or at any rate the house will outlast his lifetime and some other family or families will live in it in time. For this reason it is best to keep in mind the certainty that sooner or later the house will be for rent or for sale, therefore it should be built to conform as nearly as possible to the needs of the typical family, yet at the same time be built primarily to serve the needs of the owner's family. It should not have so much of individuality as to be freakish. The builder must remember also that his own family will change, children will grow up to be young people, and a young grown-up family will one by one leave home, for homes of their own or for business which takes them to other places than the home town.

Exposure.—When a house is placed with one wall to the north, one to the south, one to the east and one to the west, the rooms facing the south receive direct sunlight all the year round, the rooms to the east and west receive direct sunlight in summer but on the shorter winter days it is only oblique rays which reach them, while the rooms on the north have no sunlight in winter, and only a little in summer. Sunlight makes for cheerfulness, and promotes health, it is desirable to have all we can of it, especially in the winter months. If a house can be so placed that one side is toward

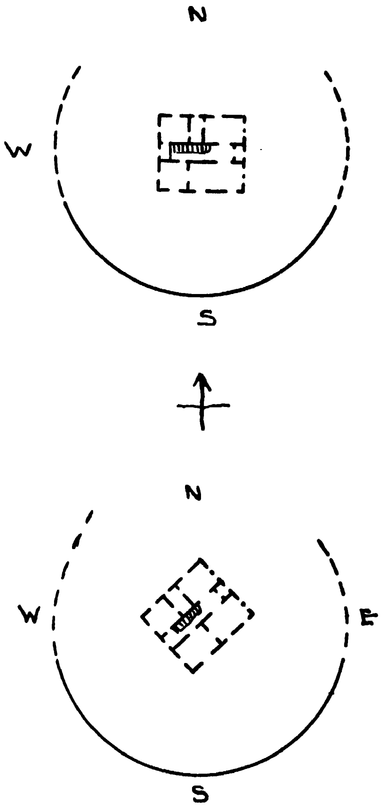


Fig. 10.—Plans to show sunlight received. Solid line shows the path of the sun on the shortest day of winter. Dotted line shows extended path of sun on longest day of summer.

the southeast and one side toward the southwest, direct sunlight during part of every day will reach more rooms than when the *house faces the points of the compass (Fig. 10).*

Floor Plans to be Considered First.*—Robert W. Gardner, who has written on architectural subjects, says: "From the stand-*

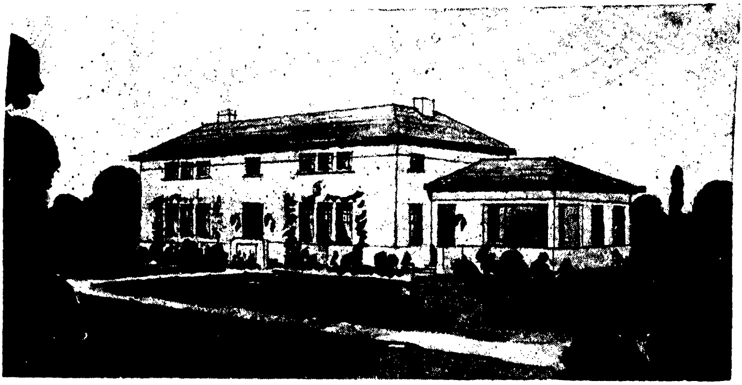


Fig. 11.—Elevation A. See Figs. 12, 13 and 14. For plan see Fig. 159.

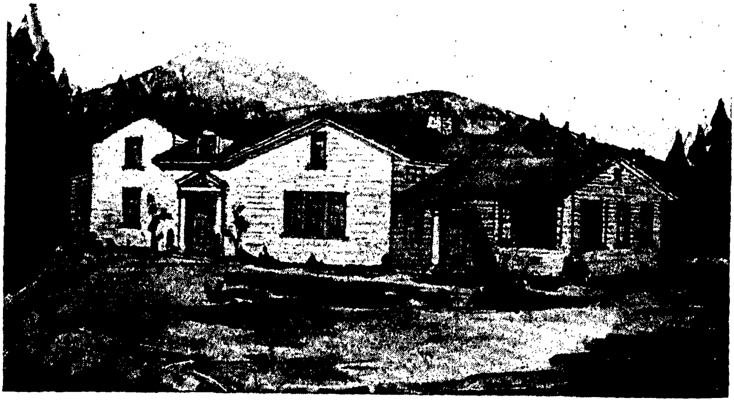


Fig. 12.—Elevation B. See Figs. 11, 13 and 14. For plan see Fig. 159.

point of the one who builds and of the one who designs building, the plan is the first consideration. Compared with the arrangement of the floors and its expression in the plan, all the elevations, façades, sectional drawings, and perspective sketches sink into insignificance. The plan comes the closest to the thought. Indeed, one architect recently well said that there is only one plan of any given structure that is really adapted to the requirements, but that any architect could continue drawing different elevations for that plan until physically exhausted (Figs. 11-14). Practically it is unnecessary to contrast the two kinds of drawings. The elevation is a corollary to the plan. It is dominated by it from the start."

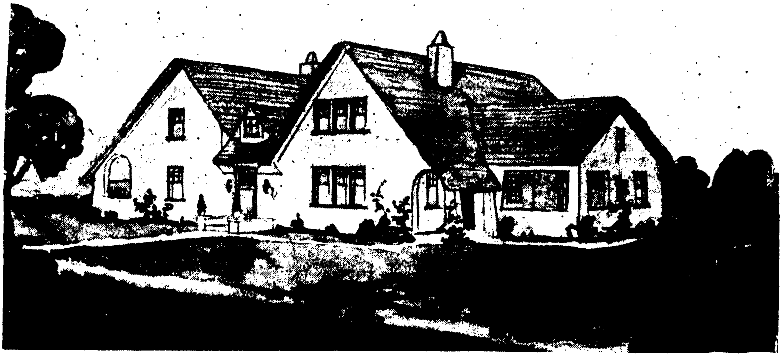


FIG. 13.—Elevation C. See Figs. 11, 12 and 14. For Plan see Fig. 159.

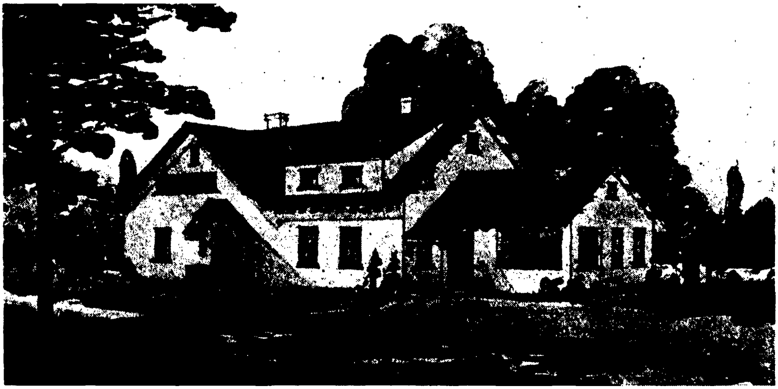


FIG. 14.—Elevation D. See Figs. 11, 12 and 13. For Plan see Fig. 159.

To find the one plan for any given structure that is really adapted to the requirements demands careful study, one must discriminate the essentials from the non-essentials, must dis-

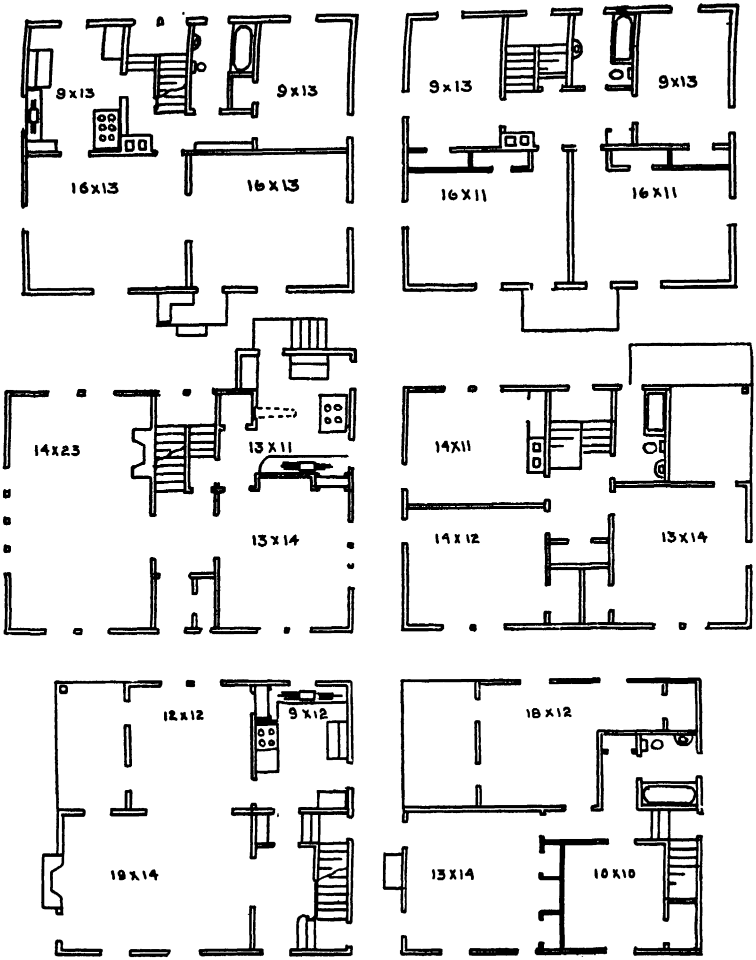


FIG. 15.—Two-story houses, square in plan.

tinguish between genuine needs and ostentation, between integrity of structure and shams, only by so doing will the one proper appropriate plan be found. Having found the right plan we can, by using suitable materials, roof lines and ornament, develop a house in harmony with the country and time in which it is built, and having those peculiar and distinctive qualities which will stamp it with individuality, and mark it as the home of a particular family. The most interesting of the historical dwelling places remaining to us, as well as those built at the present time, are the ones in which the builders were, either consciously or unconsciously, actuated by these principles.

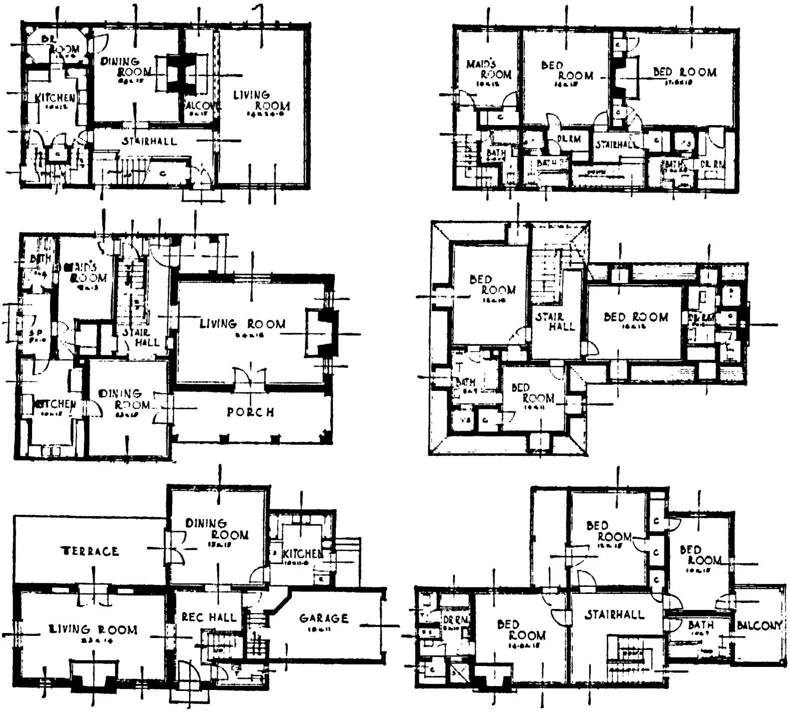


FIG. 16.—Two-story houses for wide lots.

Typical Plans.—For the small house there are a few typical general plans, but the variations in detail of these are infinite in number. Of these typical plans the majority are rectangular, approximately square, or long and narrow; there are also plans with wings, and plans with a central court. The square house is

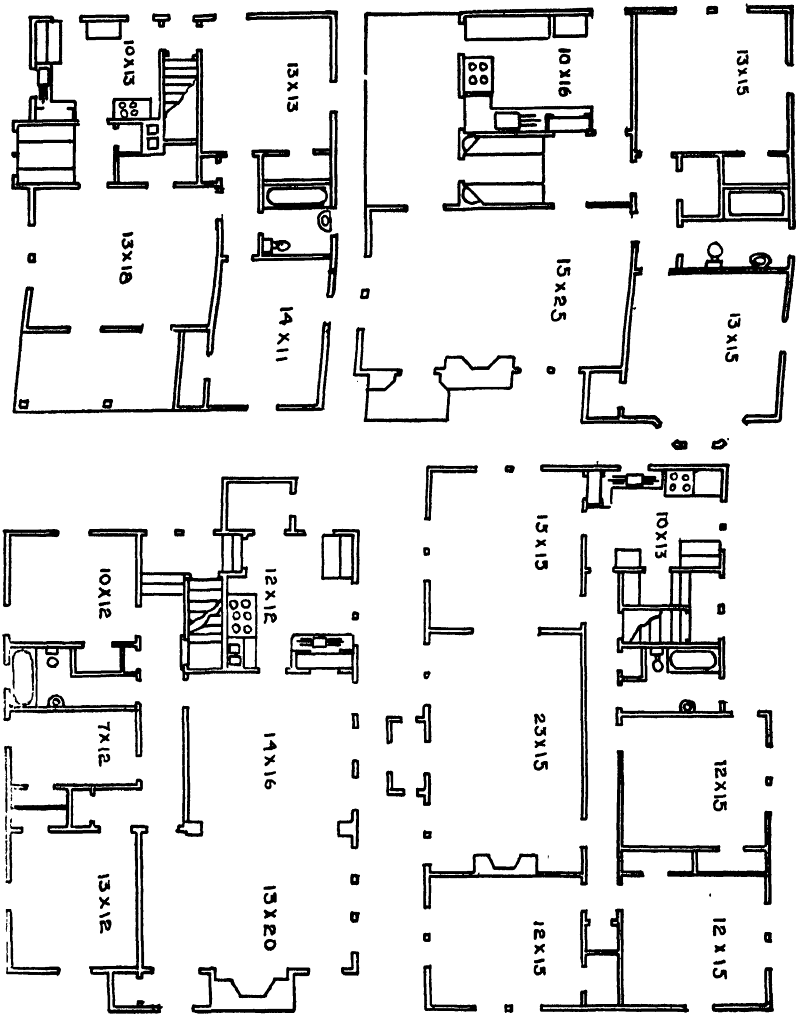


FIG. 17.—Plans for well-arranged bungalows. The two smaller of these bungalows are quite similar in plan. Each has two bedrooms and instead of a dining room, a dining alcove adjoining the living room and separate from the kitchen. One has no basement and therefore would be suitable only in the South. The other two bungalows have dining rooms and each has three bedrooms.

the cheapest to build. A square contains more square feet of floor area than an oblong of equal perimeter. The square house requires less hall space and is more easily heated than a house of another figure (Fig. 17). The size and contour of the lot determine sometimes the plan of the house. A lot twenty or twenty-five feet in width necessitates a long and narrow house which frequently cannot be well lighted or ventilated. Fortunately, except in large cities, we find few lots so narrow, a more general width is fifty feet. With fifty feet of frontage we should have about ten feet on either side for light, ventilation, privacy, and lawn. This leaves thirty feet for the house front, and permits the building of a house approximately square, or cubical if it is two stories high (Fig. 15). Such a house as this is the cheapest to build, but the proportions are not the most pleasing. A more attractive house is one in which one dimension predominates. On a fifty-foot lot the dominating dimension would have to be the length, but with a wider lot, say sixty to seventy feet, we can have a wide, shallow house (Fig. 16). Houses of the other types of plans mentioned require lots of still greater width. Some recent house plans show a very definite separation of the different types of rooms all on one or two floors, the ground plan sometimes being in the form of a cross, each arm devoted to one exclusive set of rooms. These houses have been called "articulated." A plan in the form of a cross, a hollow square, or shaped like the letter T, or E, or L is always an expensive plan to build, due to the large area which must be covered, the greater surface of outside walls and roof, and to the larger area which must be given over to passage ways; such a house is also more expensive to heat and to care for than a compact house. Of course it has many advantages, more rooms may have the most desirable exposure, better light and ventilation, and a better outlook. Most houses, however, cannot be built after such a plan, for economy's sake we must make them compact, but we should strive to make them as far as we can articulated, that is, to have each type of room separated from others of different use. In the old-fashioned, narrow, high city houses this was accomplished by the division of the house into many floors, out of sight at the back in the basement was the kitchen, sometimes the dining room also was put in this semi-underground floor, again, it was on the floor above. The floor above the basement and sometimes another floor or two were given over to parlors and libraries, billiard and smoking rooms, still further up were the bedrooms (Fig. 18). Even six-room houses were built in this way, with two rooms to the floor. While a few such houses are built to-day in large cities where land is very valuable, this arrangement is being rapidly abandoned. Better transportation facilities allow more people to live farther out from the centre of town where lots are not so expensive and where they can have more space for building. The modern apartment house furnishes homes for many who formerly lived in brownstone fronts.

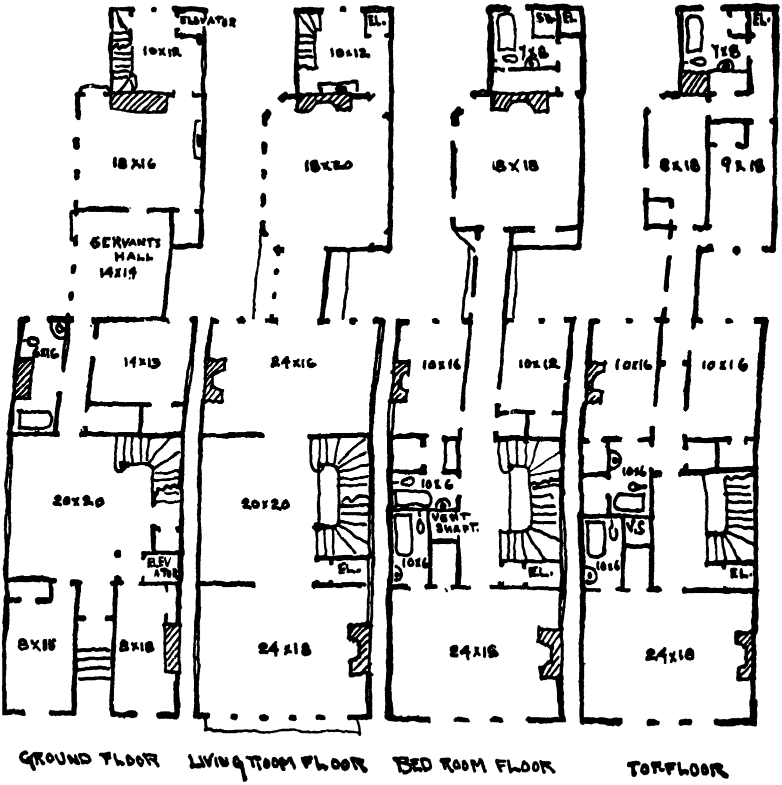
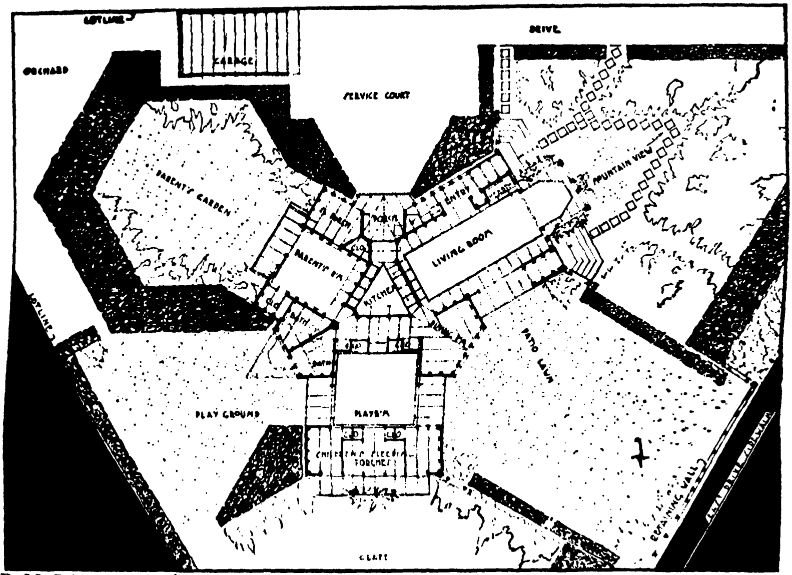


FIG. 18.—A city house.

Living Rooms.—The rooms for recreation and social intercourse, whether few or many, should be grouped as a rule to give an effect of comfort, and cheerfulness, and spaciousness. Each part of the country has its prevailing winds and these should be studied and the house so placed that the breeze may strike the living rooms first. It is becoming more and more common to put the living rooms away from the street on the garden front of the house, and in a new district where there are no unsightly back yards and house rears, this is the thing to do when the breeze comes from this quarter or when there is a beautiful outlook in this direction. The dining room should, if possible, receive the morning sun, that means an eastern or southern outlook. In order to avoid the afternoon sun, a porch for afternoon use should not be on the west. Appropriate arrangements of furniture are to be considered in planning these rooms. Doorways near a fire-



R. M. Schindler, Architect.

FIG. 19.—Articulated plan for triangular lot. One wing for social life, one for parents, one for children. The kitchen with overhead light and ventilation permits service to all wings and supervision of children. Note the garden divisions.

place sometimes make it impossible to group seats about it in a comfortable way. The entrance to the house should not be through any porch which is to be used as a living porch. It is not pleasant to have to use any living room as a passageway.

A house built for a small family in a warm climate is shown in Fig. 19. (NOTE: Dotted lines indicate the roofing plan. The ceiling slopes under them, or is lower than over adjoining areas.) The living room has the best view, but all rooms have abundant sunlight and air, and each is amplified by an appropriate outdoor extension.

Entrance.—The entrance hall may be merely a vestibule opening *into the living room or it may be a room itself with doors to other rooms and stairway leading from it. In the first case visitors must be shown into the living room at once, in the second they need penetrate no further into the house than the hall, or they may be ushered into a reception room off it. If the house is a fairly large one, the main entrance hall and stairway are generally treated as part of the living area of the house, since it is from* these that on entering one gains his first impression of the house. Therefore, the entrance hall is usually made large enough to accommodate a few pieces of furniture, and the stairway in all but the smallest of houses is made an ornamental feature leading into an attractive upper hall. The stair should be close to the entrance to permit guests reaching it and the cloak rooms without having to pass through a group of earlier arrivals and for the same reason it is preferable to have the entrance at one side of the group of living rooms, rather than in their centre.

It is a good thing to have a coat closet near the front entrance. It is also desirable to have a lavatory some place on the first floor. Often space under the stairway may be used for these purposes.

Planning on Axes.—The best appearance is gained by planning the living rooms individually and collectively on axes. For instance, suppose a central entrance hall with rooms on either side, then a line which is drawn perpendicular to and through the centre of the doorway into one of the rooms at the side of the hall should, if possible, pass through the centre of the doorway leading to the room on the opposite side of the house. Continuation of this line should terminate in the centre of a door or of a window opening, of a fireplace, or of a wall space against which may be placed some interesting or decorative piece of furniture, or where a noteworthy picture may hang. In making plans these axes should be drawn in. When an axis passing through several rooms crosses one room off its centre line in that room at an equal distance from the centre on the other side, a second axis should be drawn, and the unit, door, window or wall space which is centred on the first line should be repeated on the other. In making plans the centre lines of each room should be drawn in and all openings and other features placed to balance each other around these axes. Such spacing and balancing and centring of features on axes add to the apparent size of the rooms, for the eye is drawn along long lines of vision (Fig. 20). Such an arrangement unites all of the living rooms, giving one big living space, and at times of a large entertainment the guests are a unit, they are not divided off into a series of small groups as an unorganized arrangement of separate rooms would cause them to be divided. The dining room may be included in the living space in a small house by a large opening on one of the main axes. In a larger house it may be rendered a little more private by not being thrown into this space. It is not always desirable to have the dining room in sight or hearing from the entrance. This is, however, a matter to be settled by the individual. The stairway should be made to balance by leading up on some centre line, or by having one of the centre lines pass through the centre of one run of steps, or by being balanced by an equally prominent feature on the other side of an axis passing between them.

FIG. 20.—An effect of spaciousness.

Figures of Rooms.—Unsymmetrical rooms and irregular forms should be avoided in planning, for all jogs, projections, or recessions, break into the harmony of the plan. Such jogs, because of the angles they form, also add to the expense of building and to the difficulty of furnishing, therefore, lines should be kept straight. The form of a room may be pleasing or displeasing. Given one hundred and fifty square feet for a dining room, it would make a difference whether the room were twelve by twelve, or ten by fifteen, or eight by nineteen feet. Some architects tell us that in general the most pleasing result is attained by making the long dimension equal the diagonal of the square erected on the small dimension of the room. The regular rug sizes fit nicely into such a room. This rule is a good one to keep in mind, but it need not be followed to the letter. It should be borne in mind that the best effect is gained by grouping rooms of different sizes, that oblong forms fit together better than square ones, and that the oblong room, besides being more pleasing, is more easily furnished than the square room. In planning any room its use must be considered and space left for the furnishings. In the dining room the least dimension must allow for the width of the table, for persons seated around it, and for the waitress to pass behind them. It is well to draw all furniture to scale.

Breakfast Alcove.—Elsewhere the breakfast alcove is discussed. This is a very attractive and convenient arrangement. In the small house and for a small family it might even obviate the necessity for having a dining room. Some other room could be used as a dining room on state occasions.

Doors.—The doors connecting the living rooms with each other should be wide and hospitable-looking and placed so there will be long vistas through the rooms and to the views from the windows, so giving an effect of spaciousness. Doors connecting this part of the house with the other divisions should be small and located in inconspicuous places.

Windows.—In placing windows one should consider not only light and ventilation but outlook, and whenever possible arrange them to frame interesting views (Fig. 21). It is the upper part of the window which is most efficient for lighting the room, but it is the lower part through which we gain glimpses of the outdoor world. French doors, that is glazed doors, may replace windows

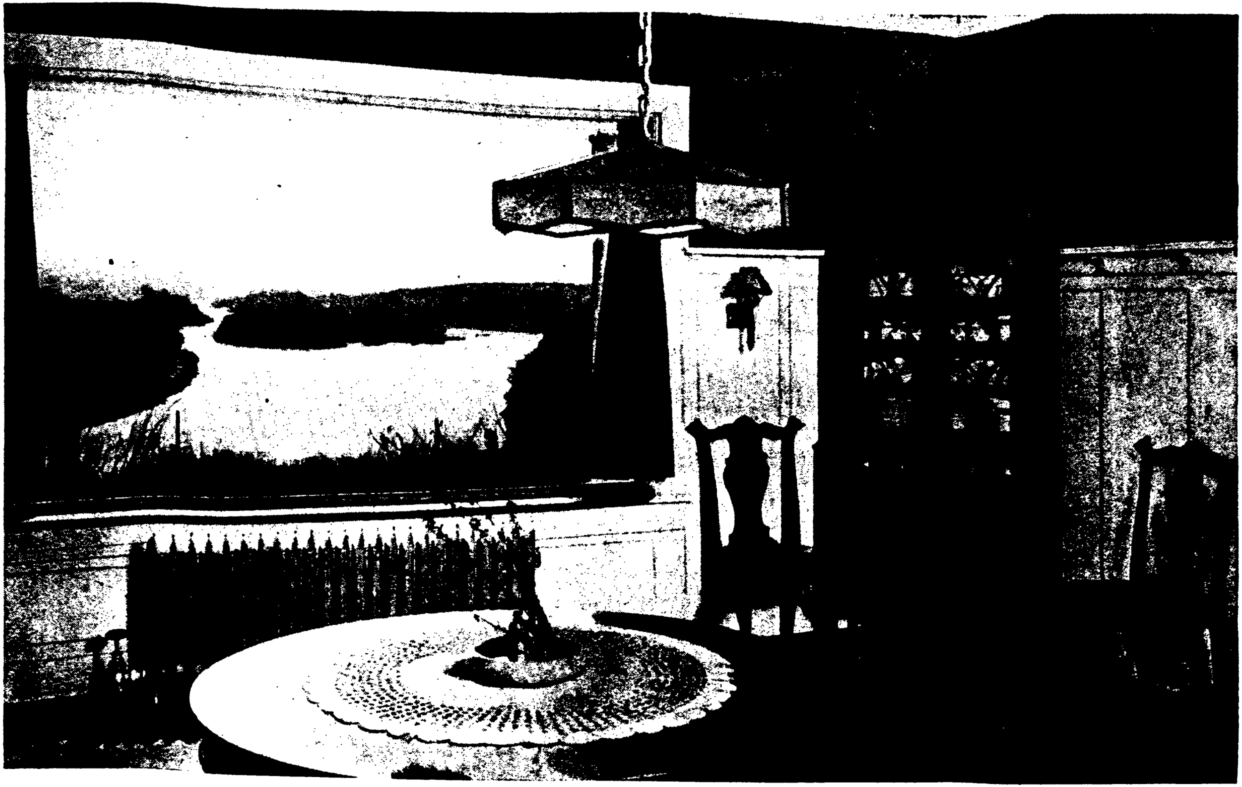


Fig. 21.—View framed by window.

when it is desirable to relate the house to the out of doors, to make easy passage to a terrace, patio, balcony, or garden. The area of the window should bear some relation to the size of the room (usually given as one-fifth), but this cannot be constant because of the fact that near-by buildings and trees may shut off some of the light and air.

Bedrooms.—The pleasantest bedrooms in a two-story house will be those over the living rooms, if these have been placed where the prevailing breezes blow into them and where the outlook is best. An eastern exposure is sometimes disagreeable because the rising sun often awakens sleepers before they wish to arise. A bedroom should be sunny and very well ventilated. Whenever it is possible to have windows in two of the bedroom walls this possibility should be taken advantage of even if it means additional expense, or some sacrifice of appearance, since windows in two walls make it easy to secure good ventilation. Every bedroom, however, cannot be on a corner, because of this it is wise in placing doors and windows to so arrange them that when all are opened there will be direct currents of air which will air the whole bedroom floor. One should not have to go through one bedroom to reach another, all should open on a hall.

Sleeping Porch.—The sleeping porch, which affords the benefits of sleeping in good, fresh air, and the comfort of a warm room to dress in, is in use in many parts of the country. Where the winters are severe, or where winds are high, sleeping porches should be enclosed with windows which may be closed on one or all sides as the weather necessitates. The sleeping porches we see do not always add to the beauty of a house, but by planning them so they do not project beyond the walls of the house, by having the openings not over large, and by making the porches themselves small, they may be made inconspicuous, and if well spaced and placed they will give character and interest to the dwelling. In planning them care must be taken that the dressing rooms with which they connect are not robbed of air and sunlight.

Size of Bedroom.—The size of a bedroom should be dependent upon its use. If it serves as a sleeping room, dressing room, and study or sitting room, it is apparent that it should be larger than if it is used merely to sleep and dress in, or if it is used as dressing room and study only, in connection with a sleeping porch. Even though every member of the family sleeps out of doors there must be one or two bedrooms larger than dressing rooms for guests, and for emergencies, such as sickness. In placing doors and windows space must be left for the bedroom furniture. In each bedroom or dressing room there should be a well-lighted space for the dressing table, and the person seated before it. If the dressing table cannot be placed between two windows, we might follow the example of some Europeans and place it directly before a window at a distance in front of it of two or three feet. The bed must not be in a stuffy alcove or corner, but where the fresh air will reach the sleeper's face. The best standards require the bed to be free-standing, that is, such a spacing as will provide an area for the bedstead so that there is free access to both sides of it. Any door of entrance into the room should be so placed that when partly opened the greater part of the room will be screened by it and not fully revealed, in order that one may have some degree of privacy with the door ajar. Closet space for each bedroom must be provided. A closet door, when open, should admit light from a window to the closet, but it should not expose the contents of the closet to the whole room, or to view from the hall. A wide, shallow closet is more convenient than a deep, narrow one, and a rod for coat hangers adds to the space available for hanging. The United States standards for housing construction during the war required a closet at least twenty-two inches deep. A large closet may be fitted up with drawers and shelves besides the rod for hangers.

Linen and Broom Closets.—There should be a linen closet on the bedroom floor, and, if possible, a closet with a sink for brooms and mops, vacuum cleaner, and other house-cleaning implements. This closet should be placed close to the bathroom in order to economize in plumbing.

The Extra Downstairs Room.—In a house where there are little children and where one woman does the work it is desirable to have a downstairs bedroom where the children may take their naps. There should be a lavatory or bathroom connected with this room. This room may be used also as a play room, and as the children grow older for a school room for study. Later it may serve as a reception room, music room, or office, as the needs of the household require, for a room somewhat separate from the living area may serve many purposes. A room of this kind is a great convenience in times of sickness, when a contagious case may be isolated in it. It is also desirable to have such a room for an invalid who would find it hard to go up and down stairs. It is a good plan to have at least one fireplace in the house, as an aid in ventilation and for use in an emergency. A fireplace in this extra downstairs room would be an advantage and perhaps of more use than a fireplace in the living room.

Maid's Room.—If the household is to contain even one employee suitable provisions for her comfort should be made. A hot kitchen and a room under the roof, hot and stuffy in summer, cold and dreary in winter, do not provide conditions conducive to the happiness and the health of the person who must spend her time in two such places. A comfortable, light, cheerful bedroom is the right of a maid and if she is not to be permitted to use the family bathroom, there should be a bathroom for her private use. Even if there is but one maid, a little sitting room of her own on the first floor where she might receive her friends, have her meals, and rest, would be a great incentive to a maid to stay on in the place where such consideration of her comfort was shown. If more than one maid is likely to be employed, there should be a minimum provision of such a sitting room and a separate bedroom for each maid.

Rooms Under Sloping Roof.—In planning rooms under a sloping roof, we need to know at what point under the roof there will be head room. If the roof begins where the floor and wall meet there is less livable space than there would be if the wall were carried up three or four feet above the floor. The floor area under a sloping roof must be planned in connection with a study of the exterior in order to have a good exterior as well as conveniently arranged floor space. In making the plan the line of head room is drawn in, in dotted lines; the floor area beyond these lines is useful for some purposes, although grown persons may not walk there. In most cases, however, it is advisable to have a wall along the line of head room, and to use the space beyond for storage space either as closet room or by building into it wall-beds, drawers or other similar features.

Work Rooms.—The rooms for caring for the physical needs of the family cannot be grouped as are the living rooms and bedrooms, for they must be placed where they will most conveniently serve their purposes, the bathroom with the bedrooms, and the kitchen near the dining room. We often find a vertical grouping of these rooms which is an economy because it brings the different sets of plumbing one over the other, so saving piping.

Bathroom.—The bathroom, or bathrooms, unless private ones, should open on the hall. The bathroom requires sunshine and good ventilation; that is, always a window direct to the outer air. Its size depends upon the number of fixtures it is to contain and their sizes. The shower bath is being more and more frequently installed in addition to the tub, but it is not wise to substitute the shower for the tub bath. A closet for toilet articles and medicine and a larger closet for towels should be included in the plans for the bathroom. It is a very good plan, unless the house is well supplied with bathrooms and lavatories, to have the toilet in a closet separate from the bathroom. This closet should, of course, have a window to the outside, and should have a lavatory basin.

Laundry.—In the house of the woman who does her own work the laundry should be on the first floor where she can supervise her children and attend to other household tasks without going up and down stairs. In other cases the laundry may be placed in a wing of the house or in the basement or in a wash house away from the dwelling, for the work done there does not require easy communication with the rest of the house. Good light and ventilation and a dry floor are essential for the laundry (Fig. 22). A closet in the laundry is a good provision for storing soap, starch, and other laundry supplies. The laundry may be very simply equipped with stationary tubs, washing machine and stove, or besides these it may contain drying racks, a clothes boiler, a mangle and ironing board. Many laundry tubs are set too low and working at them is a back-breaking task. It is well to set them with the tops about thirty-six inches from the floor. If a person who uses them is so short that this height is uncomfortable, a platform before the tubs will remedy the difficulty, but there is no way in which to make it comfortable and easy for a tall person to work at tubs set low. Whatever the laundry equipment may be, it should be placed so as to secure good light at the tubs, mangle and ironing board, and tubs, boiler and drying rack should be close together.

Kitchen.—*The modern kitchen is very different from that of* our great-grandmother's day, when the same room served as living room as well as kitchen (Fig. 23), where spinning and weaving and other work were carried on, and when it sometimes served also as bedroom. The smooth surfaces of metal, enamel and glass, make modern kitchens sanitary and easily kept clean. Conveniences of which the older generation never dreamed, gas and electric ranges, the white enamelled sink, the built-in porcelain refrigerator, and the conveniently arranged work table have made kitchen work a pleasure. The kitchen has become essentially a workshop for the preparation of food (Fig. 24). When the work there is done, the housewife goes to other parts of the house to sew or read, visit or rest. Using the kitchen for purposes other than the preparation and serving of meals and the care of the utensils and dishes used

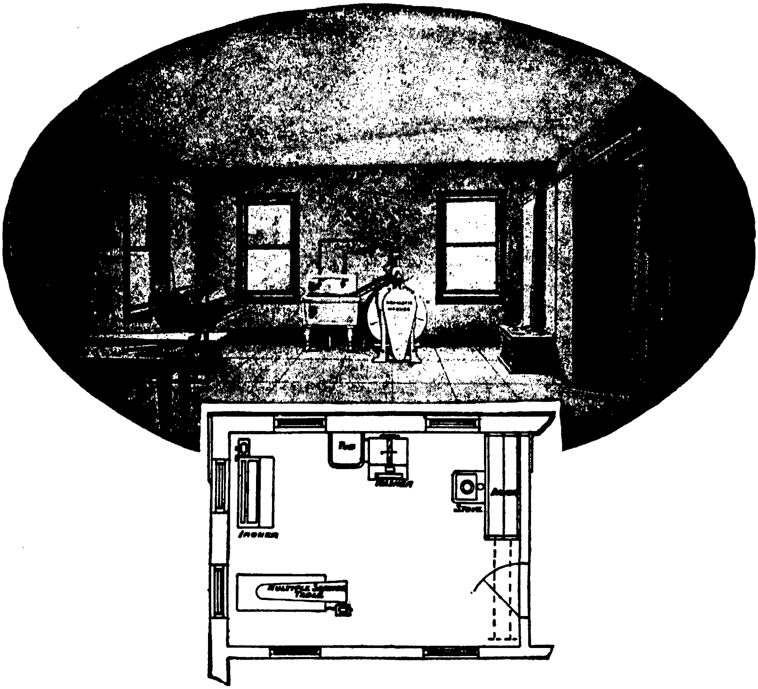


Fig. 22.—A light, well-equipped laundry, suitable for a large household.

in doing this, using it as a place for cleaning dirty boots, for depositing wraps, for washing, shaving, and hair dressing, as we often find it used in the country, and in poorer houses in town, tends to be unsanitary and to interfere with the work of food preparation.

In planning improved dwellings for workingmen's families, it is still an open question whether to make the kitchen large enough for living-room purposes; the necessity of reducing the number of rooms and the tradition favoring the large kitchen among such families may make it seem necessary. The question is this: If there are to be only two general rooms for a family (in addition to bedrooms), shall one be a kitchen and the other a combined living and dining room, or shall there be a combined kitchen and dining room and a separate living room?

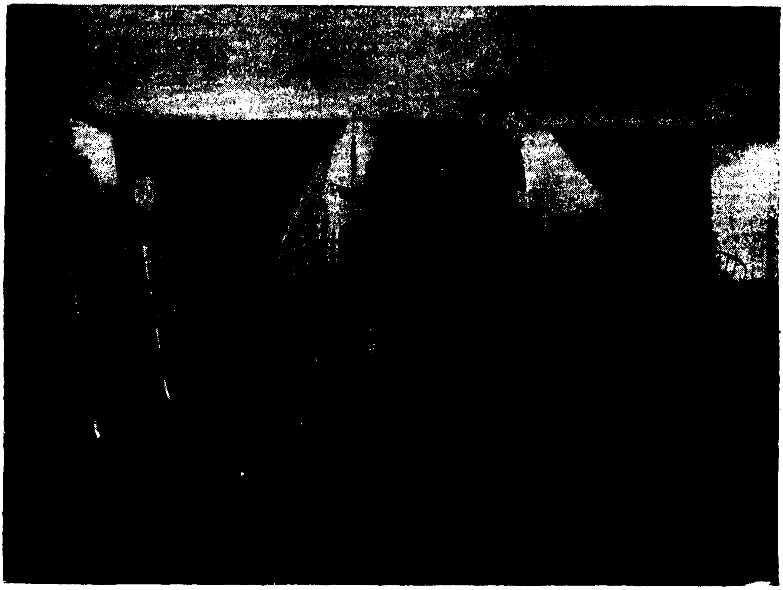
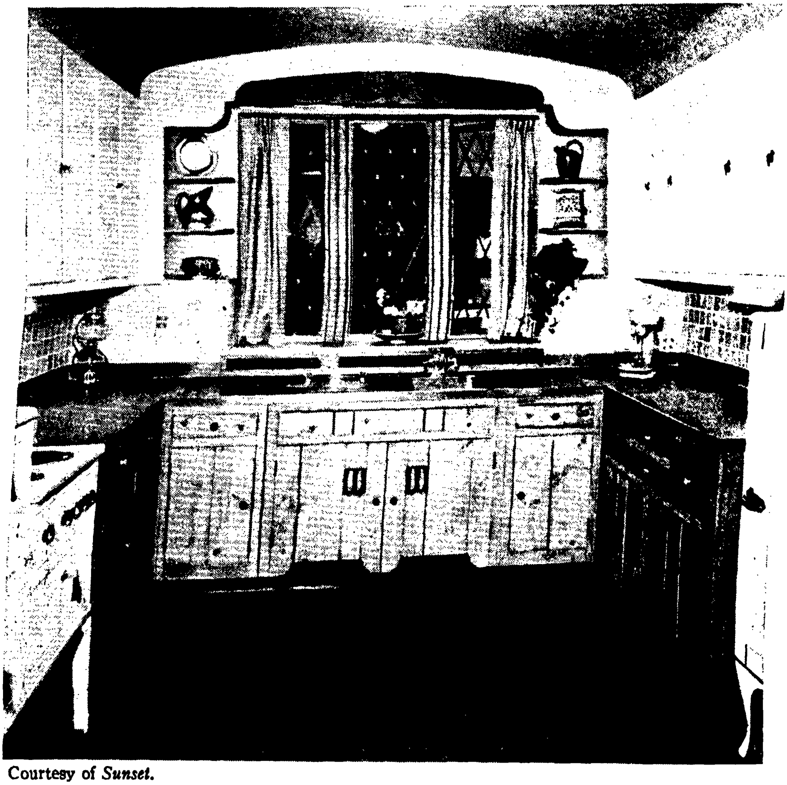


FIG. 23.—A kitchen of long ago.

Kitchen Location.—Before our great-grandmother's day there was a time in the evolution of the house when the kitchen was a workshop in a separate building, but at present it is an integral part of the house. It is usually put in the rear to be out of sight. Frequently, however, the rear of the house has the best exposure as to breezes, sunlight and view, it is a pity in such a case not to have the living rooms on this side. Often a kitchen at the rear is very much in evidence because of the odors which the prevailing winds blow from it through the rest of the house. In such cases it is best to depart from custom and have the kitchen at the front, where, in a well-designed house, it need not spoil the appearance



Courtesy of *Sunset.*

FIG. 24.—A modern all-electric kitchen, with range and refrigerator in foreground, from General Electric Institute, Nela Park, Cleveland. Note metal work-table top and sink, built-in dishwasher, metal storage cupboards above the work-table, pine ones beneath which might also be metal, and the ample window.

either from the outside or the inside. A northern exposure is desirable for pantry and storeroom in order that these rooms may be cool as possible. The kitchen and pantry should have good light and good ventilation, to make them attractive, convenient and healthful places in which to work, and to keep the other parts of the house from being penetrated occasionally by odors.

Connection With Other Parts of House.—The second thing to be considered is the relation of the kitchen to the other parts of the house. It is not best to have the rear entrance opening into the kitchen, for the use of the kitchen as a passage-way interferes with the work and causes the floors to be tracked needlessly. A place should be provided in the passage-way or vestibule into which the kitchen opens for the delivery of supplies. If the refrigerator is not electric it should be iced from this entry unless it is possible to have this done from outside the house. The kitchen should have easy communication with the rear entrance and also with certain other parts of the house. It is desirable to have the doors so placed that no view into the kitchen is possible from the front entrance. A way from the kitchen to the front door should be so arranged that in answering the door-bell one need not traverse dining room or living room or at least need not go through both. For the service of meals the kitchen should be near the dining room. A pass pantry between the two is effective in shutting out from the dining room sounds and odors. In the small house where the housewife does her own work the pass pantry is generally omitted for the sake

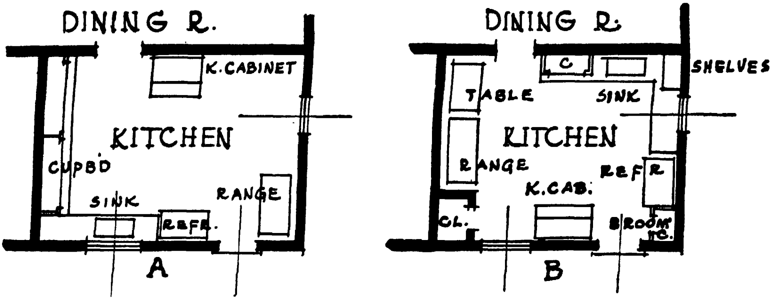


FIG. 25.—Plan A shows a poorly arranged kitchen. Without changing doors or windows, the equipment has been re-arranged in plan B to save steps.

of saving steps. For the best arrangement, the kitchen should be so situated in the house that it is not a passage-way and it should have easy accessibility to rear entrance, rear stairway, lavatory, cellar, store room, dining room, and front entrance. Usually a house is planned in such a way that several of these places are reached from a rear hall or entry (Fig. 32).

Size.—The kitchen should be of a size to provide for the kitchen work, but no larger, for extra room means more labor and more expense. A kitchen of one hundred and fifty square feet is of ample size even for a large family. If in planning the kitchen the wall spaces are arranged to fit the equipment to be used, a much smaller area than this is sufficient as shown in (Fig. 30). These kitchens have equipment of full size. When smaller sizes of equipment are used the areas may be still further reduced. A smaller kitchen saves steps, for in it all the furnishings are close together, none must interfere, however, with the direct path between other articles of furnishing. It is always possible by careful planning to secure light, ventilation and well-arranged equipment (Figs. 24, 28, 29, 30).

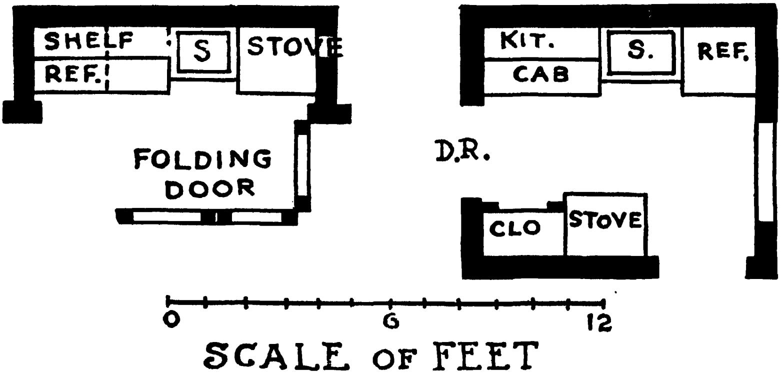
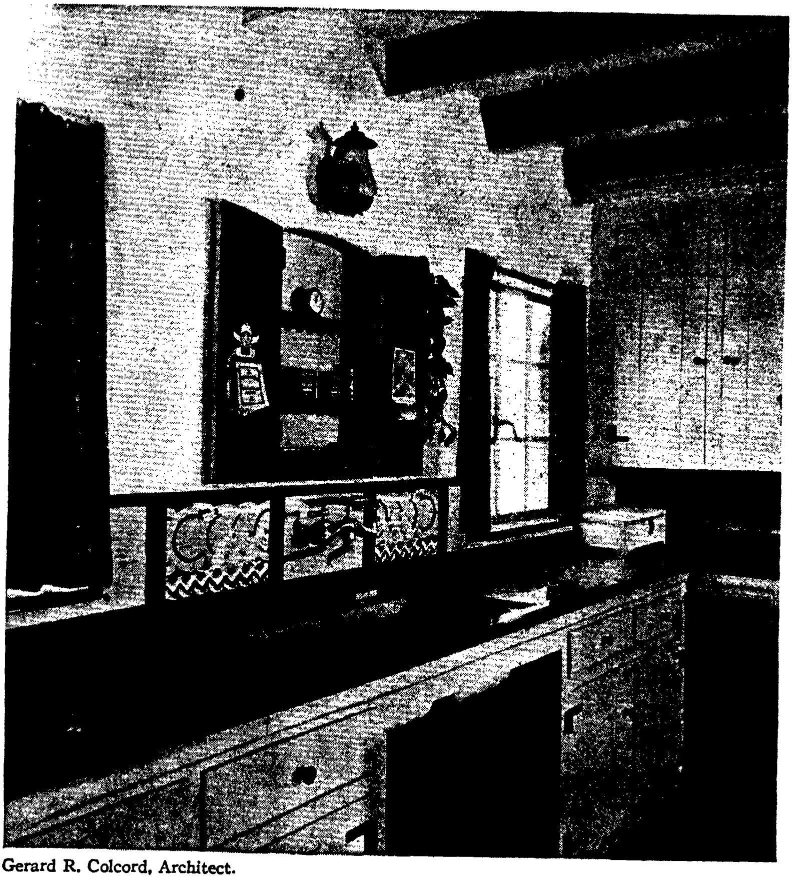


Fig. 26.—Well-arranged kitchenettes.

Furnishings and Their Arrangement.—In planning the kitchen we must carefully consider the furnishings and arrange for the proper placing of stove, sink, work table, cupboards for supplies and utensils, refrigerator, doors and windows in order to have all of these in the proper position in regard to each other and to the work to be done. Kitchen work may be divided into four stages;

preparation of food for cooking, cooking, serving, and clearing away including dish-washing. Specialized equipment both large and small, is needed for each stage, and the placing of it should be such that the work may be done with the least expenditure of time and labor. The sink is used in the preparation of food for cooking and in dish-washing. Its position in regard to dish-washing is most important. For this work it should be near the dining table and near the dish closet. The easiest way for a right handed person



Gerard R. Colcord, Architect.

FIG. 27.—A combined work-table of tile and double sink.

to do dishes is to have them stacked at the right of the sink, to wash them in the sink, to drain them on a left hand drain board, and to put them away in a cupboard just at the left of the drain board. If the door to the dining room is at the left of this dish closet, the dishes are near the dining table and one person may set the table without interfering with another person working in the kitchen (Fig. 31). If the dish cupboard is a two-way one, opening into both kitchen and dining room, it is still more convenient and in this case the door to the dining room need not be next to the dish closet (Fig. 28). Since hot food is served from the stove, it is convenient to have the stove near the dining room

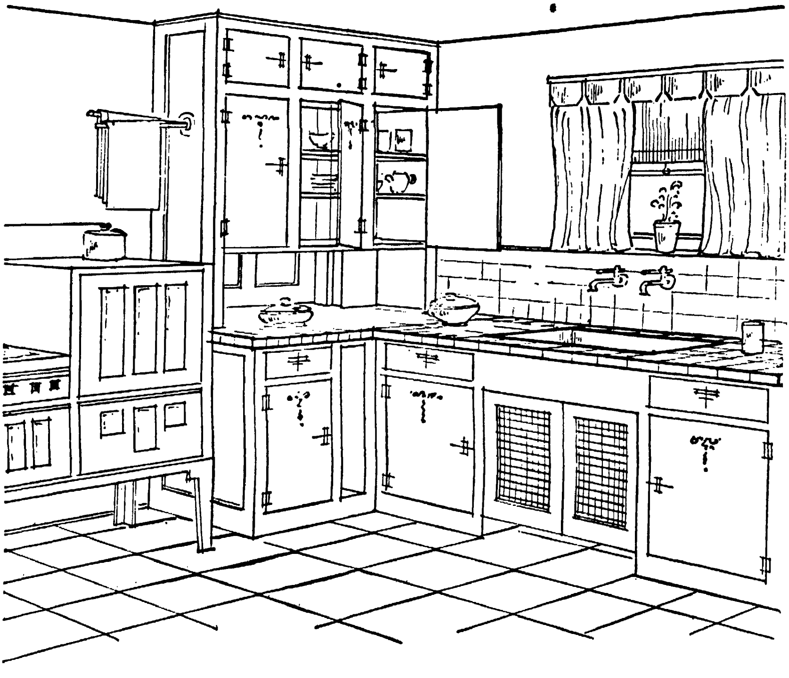
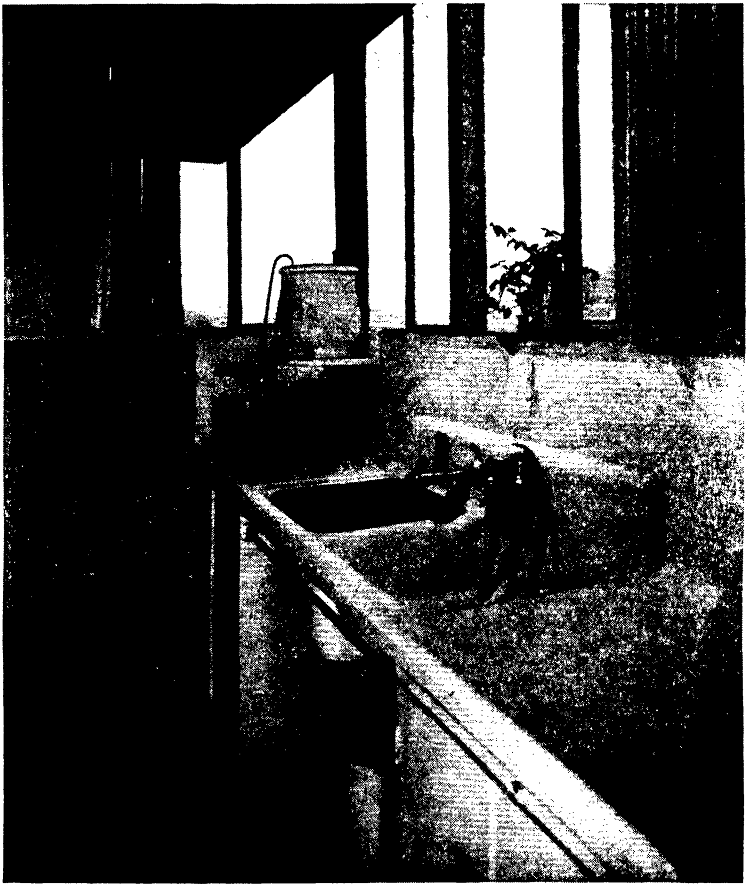


FIG. 28.—A view of the upper kitchen shown in Fig. 31 illustrating the pass closet. Beyond the dish cupboards and the tiled work surface at the left is seen the door in the dining room which when opened gives access to the articles in the two cupboards to the left and on the work surface.

door or near the two-way dish cupboard. When solid fuel is used it is a good plan to have the stove close to the door through which this fuel is brought into the kitchen. The location of the flue must be planned in relation to the best position for the stove. The work table where batters and doughs and other things are mixed may be a built-in one with the sink as shown in Figs. 24 and 27 or it may



V. D. L. Research House at Silver Lake, Los Angeles. Richard J. Neutra, Architect.

FIG. 29.—**A beautiful kitchen.** View over jointless resilient drain boards, electric dishwasher, and water filter.

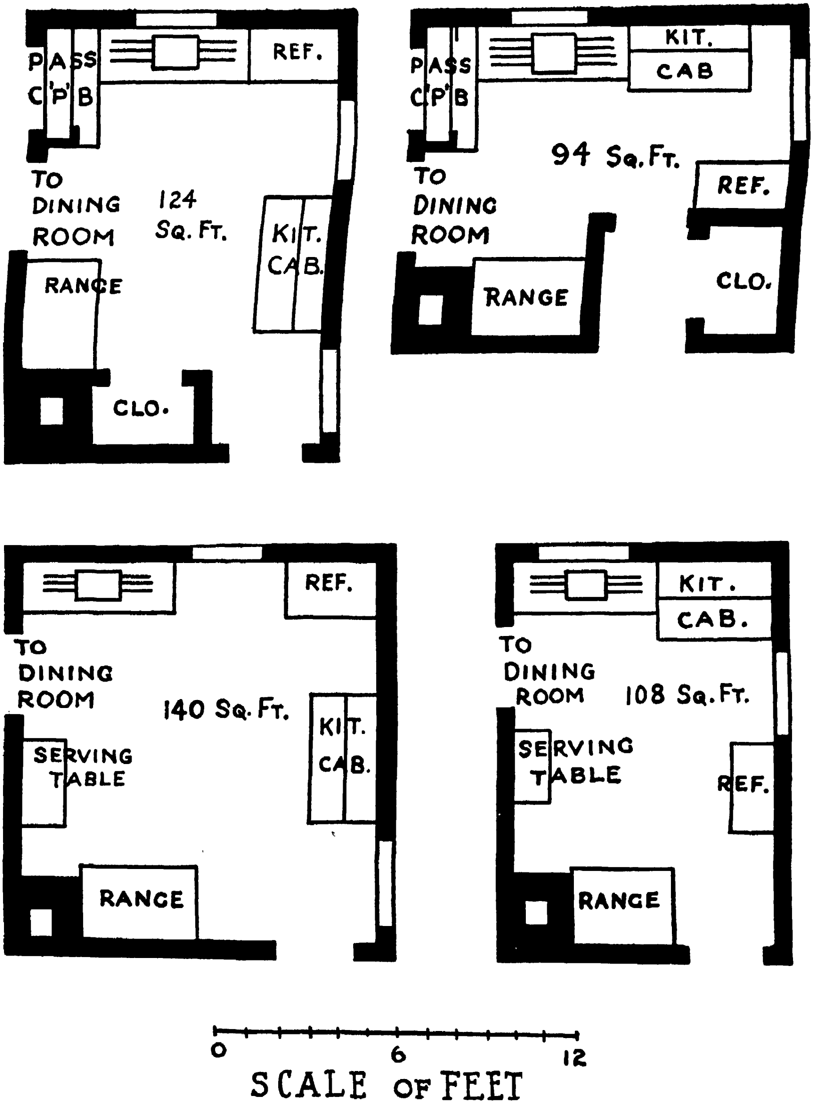


FIG. 30.—These kitchen plans illustrate how by careful study there may be good arrangement in a small area. Each of the plans shown at the right has a sink, kitchen cabinet and stove in practically the same relative positions as in the corresponding kitchens at the left. In each case the kitchen at the right has thirty square feet less of floor area than the kitchen at the left and the equipment is the same.

very well be some sort of movable commercial kitchen cabinet. The refrigerator holds foods ready for the table and articles for use at the work table, therefore, it is well to have it near one or the other of these. The smaller kitchen furnishings should be kept where they are used, the dish-pans and other dish washing utensils and supplies, and also the double boilers and kettles for boiling vegetables, the paring knives and the garbage pail at the sink. Fry-pans, covers, pepper, salt, flour, sugar, coffee, tea, and matches are used at the stove. A shelf or two and a few hooks beside the stove will serve to keep them where they are needed. The work table should have space for flour, sugar, seasonings, flavorings, bowls, spoons, cake pans, and similar ingredients and articles. The dish closet should be large enough to be a serving center and to hold bread, cake and such foods as are ready for the table as well as all the dining table equipment. These articles should all be considered

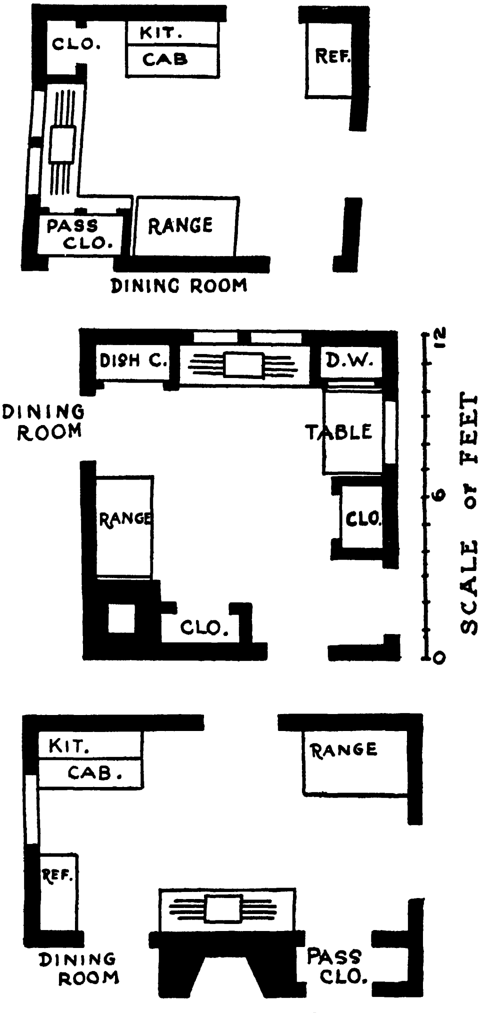
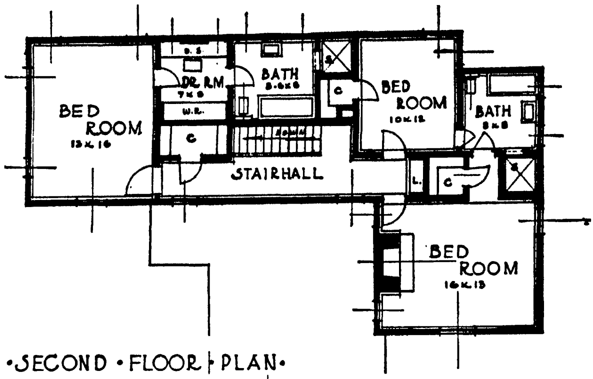


FIG. 31.—Three different good kitchen arrangements.



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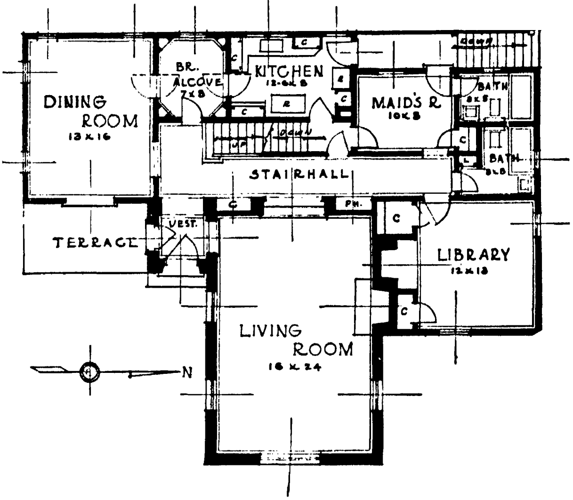

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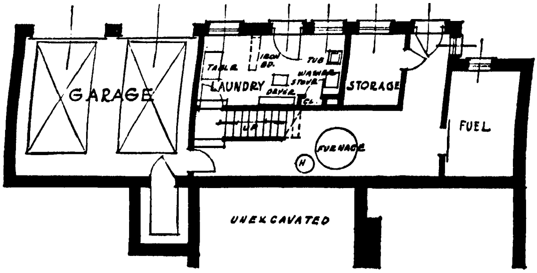

•BASEMENT•

FIG. 32.—Plans of a well-arranged house in which proper provision is made for doing the kitchen work easily and for convenient communication with the other areas of the house.

in kitchen planning. Many kitchens do not have satisfactory daylight, and in planning we must be sure that there will be enough light at the sink, the stove, and the work table and that as the worker stands at each of these, her shadow does not fall across the work surface. Windows in two walls are desirable to provide good light and also to secure good ventilation. The upper part of the window is the most valuable for ventilation and for letting in light that falls on the kitchen work surfaces, so in kitchens with limited wall space, high windows with space for equipment below them are good. It is always possible by careful planning to secure well arranged equipment, good light and ventilation.

Food Storage.—All of the food supplies should not be kept in the same place. Dry staples must be stored in a dry place, a cupboard near a chimney is very satisfactory. Large amounts of supplies which are in daily use may be kept in a storeroom or pantry and small quantities in bins of the work table. Butter, milk, eggs, perishable fruits and vegetables should be in a cold place. These may be conveniently kept in an ice box, if possible iced from the outside, a cooler, or a window box. They might be kept in a cool part of the cellar, but this would not be so convenient. Large supplies of vegetables and fruits are best stored in a cold, dry, well-ventilated part of the cellar, and the daily supplies of these brought up to the kitchen each day. Canned goods keep best in a cool place and the color of fruit and vegetables canned in glass is preserved when the jars are protected from light.

Some Dimensions.—*In any given kitchen one cannot have* everything in the way of arrangement and conveniences, but every part of the kitchen should be most carefully thought out so that *the inevitable compromise may be the arrangement which gives the very best results possible. Whatever the arrangement may be, there are some details which should be kept in mind. In planning* a work table or placing a sink it is important to get it at the right height. This depends on the height of the person who works at it. Average convenient heights are thirty to thirty-six inches from the floor to the working surface, which in the case of the sink is the bottom of it, and not the rim. If a sink or table is low a tall person must bend her back to work at it, but if it is high, it is less fatiguing for a short person to work at a level slightly higher than the one most convenient, than it is for a tall person to stoop, In planning shelving, the use of the shelves must be borne in mind. If room is desired under the lowest shelf for a barrel it must be set thirty-two inches from the floor. Deep shelves are necessary for large boxes or other large articles. A shelf for a bread or cake box must be deep enough to allow the box to be pulled forward and opened, and there must be space enough above to swing the cover. One look at a shelf should reveal everything there is on it. A shelf twelve inches deep will hold the largest plates, or the largest cooking vessels ordinarily used. Shelves three inches, four inches, and six inches deep should be provided for spices, flavorings, baking powder and other small packages or articles. The distance at which

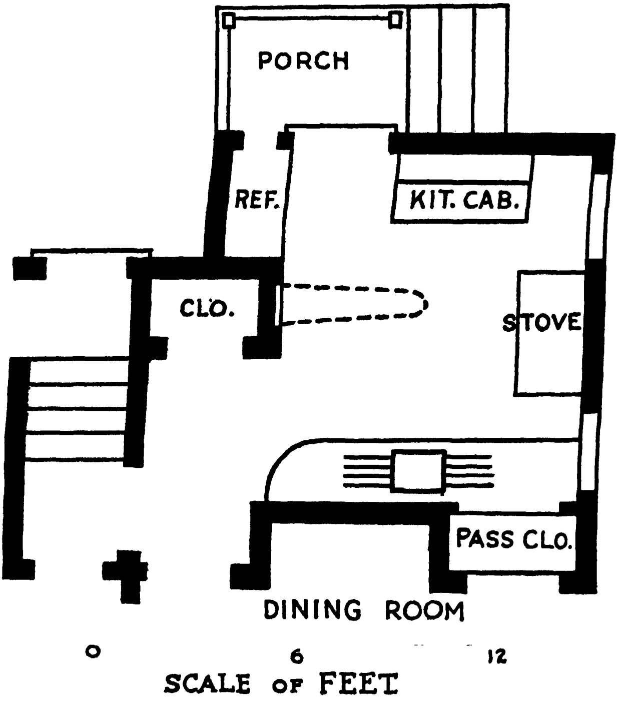

FIG. 33.—A well-arranged kitchen. The refrigerator may be iced from the porch.

one shelf is placed above another should be studied so as to arrange the shelving to accommodate large packages or articles, and to avoid wasting space above the shelves where small ones are kept. A shelf that is above the head is good only for storing articles that are infrequently used. There should be a shelf five or six inches deep for account books and cook books. Drawer space for the things the house-keeper prefers to keep in drawers rather than on shelves must be considered. Small cooking utensils may be kept in shallow drawers. There should be drawers for towels and for aprons, and these should be deep enough to hold a week's supply. If cupboards have doors which roll up like the tops of roll-top desks or slip back as do some book-case doors, space is saved.

Finishes for the Kitchen.—*In finishing the kitchen the most* important thing is to make it sanitary. The wood work should be plain in order that it may not catch dust. The floor should be tight, non-absorbent, and easily cleaned. If tile or a composition is used, the base board should be of the same material and made with a curve at the floor line instead of an angle which will hold dust. Base boards or skirtings of wood built with a curve at the bottom may be had, and are more easily kept clean than the ordinary skirting. The walls should be of some smooth-finished, non-absorbent washable material.

Halls.—The different sets of rooms in the house must be grouped together and connected by halls and stairways. Sometimes a hall is a large central space which connects the rooms. In this case it becomes a gathering place or living room, and is part of the living area of the house. A hall may be merely a corridor or passage-way leading from one place to another, opening into many apartments. The use which is to be made of the hallway must be considered in determining its width. Hallways are in a sense waste space, and therefore to keep the cost of building down it is important we should minimize the amount of area devoted to them by not making them unnecessarily wide and by avoiding cross halls as much as possible. When a hallway is used only as a passage it need be only wide enough to allow two people to pass, and to permit furniture and trunks to be moved through it. If the hall is short, if there is not a wall on each side, but if on one side there is a railing and a well hole or stairs leading up, then it may be made narrower than if it is long and with a wall on either side, for in the latter case the hallway looks even narrower than it is. We should see to it that all hallways are well lighted by windows where possible and by artificial lighting, of course.

The Basement.—The basement is planned after the arrangement of the first floor has been worked out, for there must be supporting walls or arches or girders to carry the floor joists and first-floor partitions. Floor joists are continuous for the floor of any room, so we find a partition at the line where the floor joists end. A supporting wall or girder is not required under every partition, for sometimes a partition is erected over a line where there is no break in the floor joists, but there must be such a support for the ends of joists. The floor joists may continue under one or more partitions, if the span is not too long; about twenty feet is the maximum length of span used in the small house using wood joists. Studying the plan of the first floor, we determine which is the best way to have the floor joists run, keeping in mind the fact that short joists are less expensive than long ones and that they come in lengths of even numbers of feet. Of course, joists may be cut down to any length, but this is an additional expense and a waste of material. Having determined the direction of the joists, and the partitions under which they end, we plan for a bearing wall, arches, or posts and a girder, under these partitions, and with these located on our basement plan, we proceed to a division of the floor space.

Uses of Basement.—The basement of a dwelling furnishes suitable room for many purposes. Fuel bins and the furnace are in the basement. It usually contains the household supplies of vegetables, fruits and canned goods. If there is no attic storeroom, trunks may be kept here. It is a convenient respository for gardening implements and other kinds of tools. In many cases the basement also houses the laundry, although this is a poor standard for the woman who does her own work. That part of the basement devoted to laundry space must have good windows. If the house is built on an uneven site so that the ground slopes away at some point, part of the basement will be largely above ground, and this part is a good place for the laundry, for a garage, a storeroom, or a workshop (Fig. 34). Where the ground is level an area is often built to secure light for a basement laundry, but this arrangement does not insure enough light or proper ventilation and therefore in such a case the laundry can be better placed on the first floor where good working conditions may be secured.

Planning the Basement.—It is no simple matter to properly apportion the basement space for these many uses. In order to get the maximum of heat from the fuel burned, the furnace must be placed with due regard to the flue, the air intake, and the distribution of warm air, steam or hot-water pipes. This is discussed in the chapter on heating. The fuel should be kept near the furnace and we should consider the way in which it is to be put into the house. Sometimes it is possible to have a chute so coal may be run out from the delivery wagon through this chute into its place in the cellar, thus reducing labor and avoiding unsightly piles of coal before the house which often injure the lawn and certainly produce dust and dirt. The furnace heats the basement, but the fruit and vegetables should be kept in a cool place which must also be dark and well ventilated. This means that a suitable space should be walled off for vegetable storage. Unless furnace and fuel are separated from the rest of the basement the whole basement and everything in it will be showered with ashes and coal dust, so it is best to partition off spaces for the different uses to which this part of the house is to be put. There should be an outside entrance to the basement so that the furnace man and others having business there may not be obliged to go through the house. Gas, water and electric meters should if possible be placed in the basement near the entrance. It is well to put signs near the entrance indicating where they are to be found in order that the inspectors may go to them directly.

Drawing House Plans.—To begin our house plan we should mark off to scale the lot and the nearby buildings. We should then indicate the points of the compass, the line where the view is best, locate trees and mark with an arrow the direction of the prevailing wind. Sometimes we find the prevailing wind coming from the direction where the outlook is poorest, then we must choose between view and breeze for our living rooms, sometimes, happily, we can have both.

After a study of this plan of the lot we should determine where we want the different living rooms, porches, entrances, and the kitchen and its appendages, and any other rooms on the ground floor, and we should decide on the general shape of the house, whether long and narrow, wide and shallow, or approximately square, whatever is best suited to the location, and then begin to work out the arrangement of the rooms.

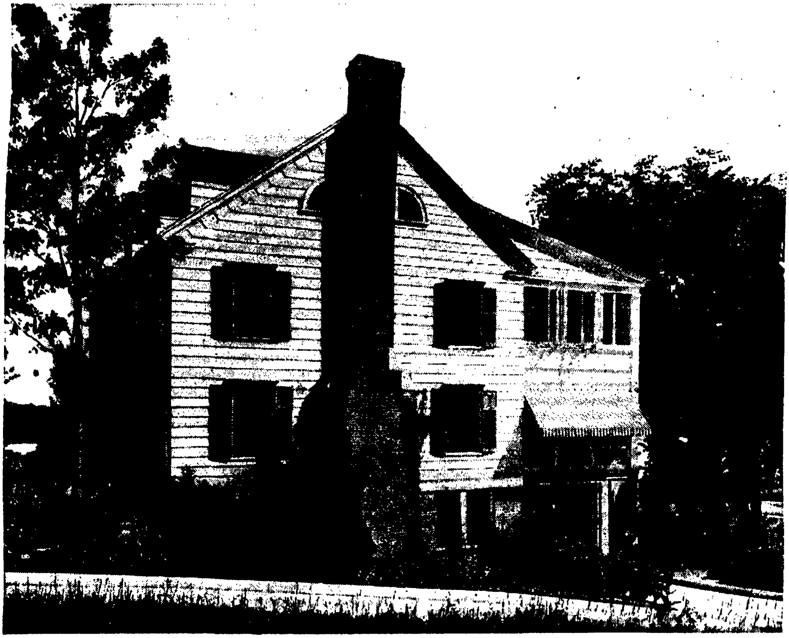

Fig. 34.—A well-designed house on a sloping site, with a good, light basement.

In making our plans we must strive to obtain the maximum of well-arranged space in the minimum of floor area. Every square foot costs dollars to build it, requires energy to clean it, and fuel to heat it, and should, therefore, either be useful or add to the beauty of the house. The arrangement should be as straightforward as possible to simplify work and to conform to the rules of architecture which require that a building of any kind should express its purpose and meet the demands of utility, that it should be free from shams, and that it should have nothing superfluous about it.

Compromises Necessary.—It must always be borne in mind that every house is a compromise between what the owner wants and what he can have. This compromise is determined by his location, the size of the lot, and the amount of money he can spend. Careful study of the problem and the conditions is well worth while, and will secure for the owner a house in which he may find satisfaction.

PROBLEMS

1. Calculate wall lengths for houses of the same area but of different shapes.
2. Look up in houses or plans pleasing arrangements of living rooms, sketch them and draw in the axes.
3. Measure the space required for a dining-room table with people seated around it and room for the waitress to pass behind them. Why should the house have a dining room? Of what value is the dining room aside from providing a place for taking meals?
4. Plan an entrance hall, reception room, living room, dining room and living porch, showing the furniture.
5. Plan a bedroom and sleeping porch showing the furniture.
6. Get a catalogue of plumbing fixtures, find out the sizes of the smallest necessary ones, and determine the least space that would be required to set these up.
7. Study your kitchen, list any faults you have to find with it. Draw it to scale, and with transparent paper study possible rearrangements.
8. Visit and write a report on two basements.
9. Criticise and improve two or three of the plans given in this chapter.

*10. Suppose that your family is to build a house in town or in the country, or is to have an apartment built especially to suit its needs. Write out your requirements for your family according to your manner of life. Go over this, selecting what you consider the essentials. Go over it again to see if you can eliminate anything. Do this for each set of rooms and in your requirements list the qualities you wish for your house, such as good construction, elegant finish, etc. Make a note of the things you would most readily sacrifice if necessary because of lack of funds. On the lot you have selected (Problem 10, Chapter II) choose the location for your house, and the exposure desired for the different rooms. Study first-floor plan for your house. With transparent paper over the first-floor plan, study the second-floor plan. Repeat for the basement. If it is desired, the student may work out the plans according to the requirements within a definite area of floor space.

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* The starred problems are those of a connected set running through the book.

CHAPTER V

MATERIALS AND CONSTRUCTION

Suitable Materials.—The modern dwelling is of frame, brick, stone, steel, tile or concrete. Not all of these materials are adapted to the same type of house although many types look equally well when developed in any one of them. If we are working in a certain style of architecture we must use the materials characteristic of that style. Each one of these materials has a texture of its own and with most of them we associate certain colors. Some of these materials are especially well adapted to certain sites, where they blend or harmonize with the landscape (Fig. 35). Usually local material does this and it is generally used because it is at hand. The use of one material rather than a combination of two or three generally results in a better appearance for the small house. When the majority of houses in any location are of a certain material and type a house of a strikingly different material or style is not in harmony with the others, and is therefore not in good taste. Many of us have seen such anomalies as the California Spanish bungalow of stucco set down among the elms and stiff, high-shouldered wooden houses of New England, or the Swiss chalet of logs built on a city street. The local materials not only harmonize best with houses already built but there is an appropriateness about their use; frame in a timbered country, stone near quarries and on paved city streets, and adobe on the desert, give satisfying effects (Fig. 36). Local materials are usually cheaper than imported ones because of the saving of transportation charges and because local workmen are skilled in using them.

The Frame House.—The majority of dwellings in this country are still built of wood because it is the most generally available material, although other materials will probably before long largely supersede it. Wood is the material most easily handled, and well-built wooden houses are durable, attractive and warm (Fig. 37). A wooden frame may be finished in a variety of ways, shingles, clapboards, plaster, and brick veneer are the most common materials used for covering the frame (Fig. 38). Houses built entirely of brick, stone, hollow tile, metal, and cement are stronger and more durable and are fire-resisting, but they are as yet somewhat more expensive than frame houses.

Construction of Basement.—There are many technical details about which an architect must have information in order to plan the cellar or basement as it should be built. Many soils require footings, that is, a broad base under the foundation walls in order to prevent the settling of the building. The proper width of the footing depends upon the character of the soil and upon the weight which is imposed upon it.

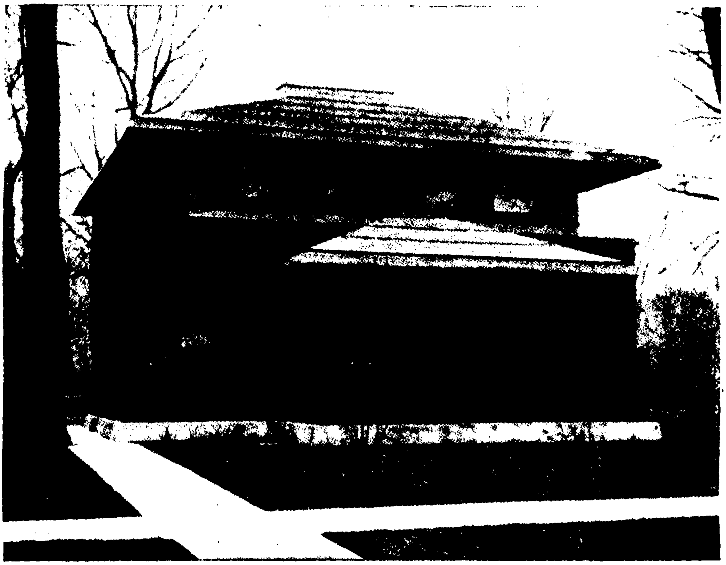


Fig. 35.—Unusual wooden finish which emphasizes horizontal lines. Suitable for a flat wooded country. Good design is shown in the carefully studied placing of windows and in the proportions of the main divisions. An example of the Prairie style.

There is also the matter of drainage to be considered. Unless the building site is naturally so well drained that there will be no danger of dampness, provision should be made to protect the house by laying drainage tiles under the walls, or by filling in a space around them with broken rock, to conduct the water which accumulates away from the building to the sewer, or to low ground. In many soils where this precaution is not sufficient to insure a dry basement the walls and floor must be water-proofed. It is possible to construct a water-tight cellar, but it is expensive; for this reason and because damp houses are not healthful places to live in, it is best, whenever possible, to select a well-drained site for the house.

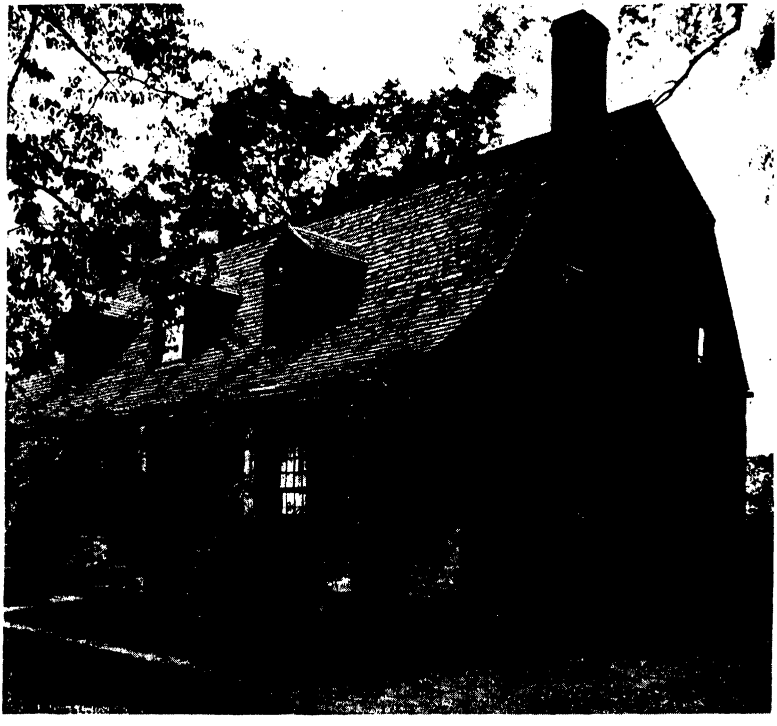


Fig. 36.—Shingles and simplicity give character to this small informal house.

In determining the depth of the basement several things must be considered, the depth to which it is necessary to go to get below frost line, the depth at which the sewer is laid, and the space needed to get the right rise on heating pipes in the basement. also the external appearance of the house.

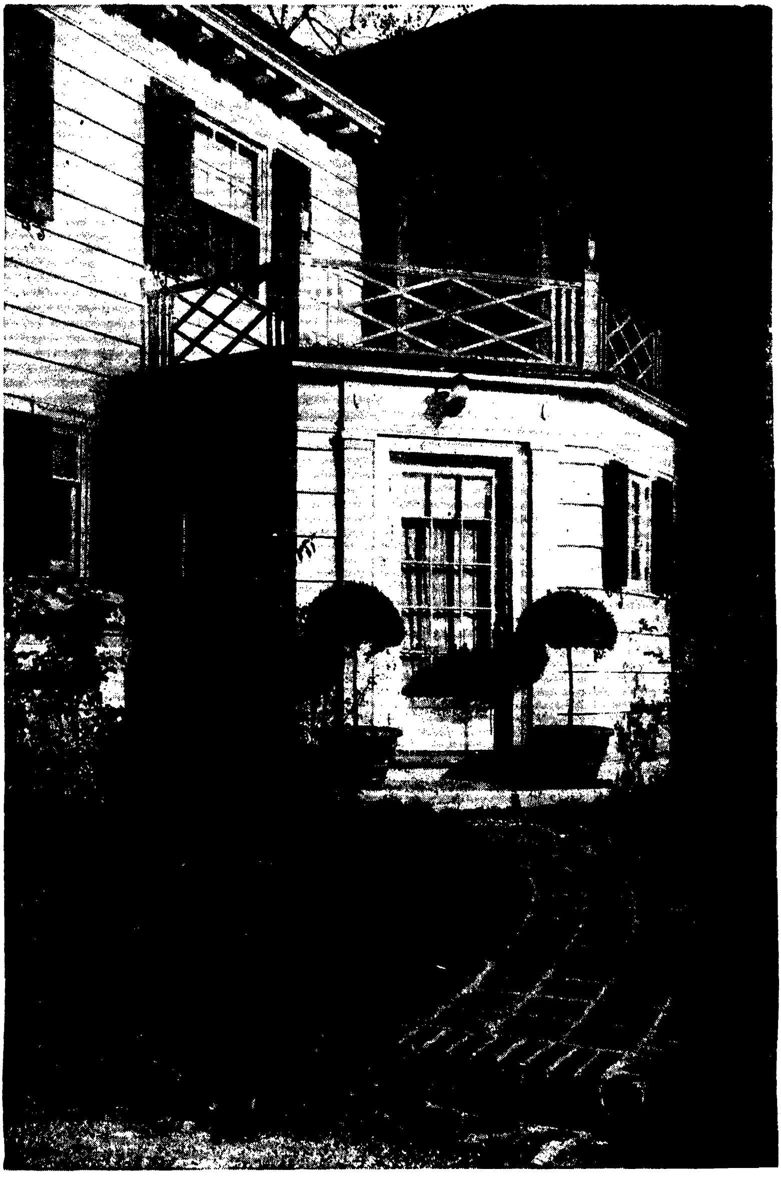


Fig. 37.—Clapboard finish is used for this interesting house in which familiar formal units of design are used to produce pleasing individuality.

The foundation walls are of concrete, brick or masonry from six to twenty inches in thickness, depending upon the material and the size of the house. In all but the smallest houses there must be supporting walls or girders to help carry the floor joists. In small houses the distance from outside wall to outside wall is sometimes not more than from sixteen to twenty feet and in this case the floor joists may be supported by these outside walls. Where the space is longer than this there should be a partition wall in the cellar, or a girder carried by posts to support one end of the floor joists (Fig. 39). Floor joists should be continuous for the floor of any room, therefore the support for the joists should come under a first-floor partition. The greater the span the more the joists cost, so it is well to have short spans, and since joists come in lengths of an even number of feet it is well to have the distance from support to support, including the bearing surfaces, an even number of feet in order to avoid trimming the joists.

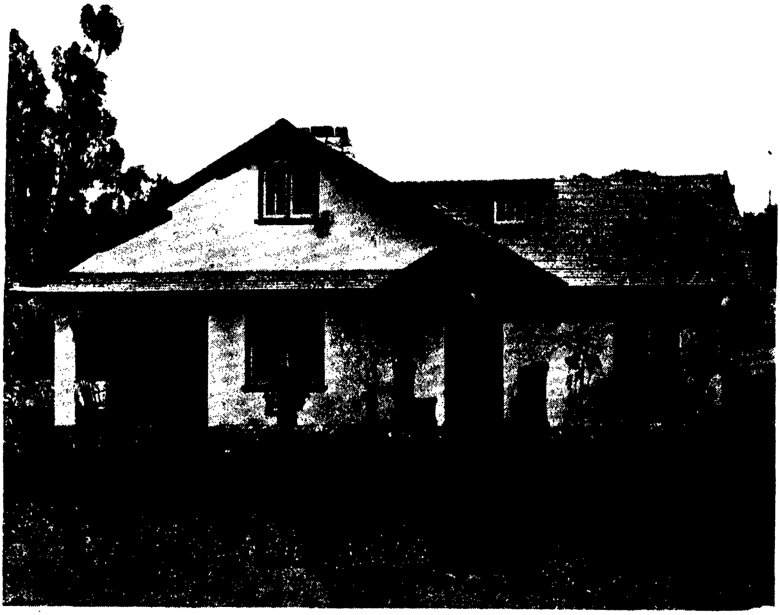


FIG. 38.—Plaster finish—a charmingly designed small house. Note the interesting contrast between the plain walls and the roof surface, and the details of the woodwork.

It is well to make the basement floor slope to a drain in the centre or at one side in order that it may be cleaned by turning the hose on it.

When any part of a house is built without a basement the space between the ground and the floor must be ventilated to prevent dry rot. In many sections termites and other insects are found which destroy wood. Where this danger exists all posts and sills should be treated with creosote or other deterrents and raised at least four inches above the ground, from which these pests may enter the wood.

It will be seen that the basement and foundation are most important parts of the house and deserve the careful attention of any one renting or buying a building. In order to have them properly built an expert who understands all the matters which require consideration should be employed to make the plans and supervise carrying them out. The amateur may study for himself the arrangement of the floor space, but this arrangement cannot always be adhered to because convenience must sometimes give way to necessity. The technical matters which must be taken into account require professional knowledge in order that they may be taken care of satisfactorily.

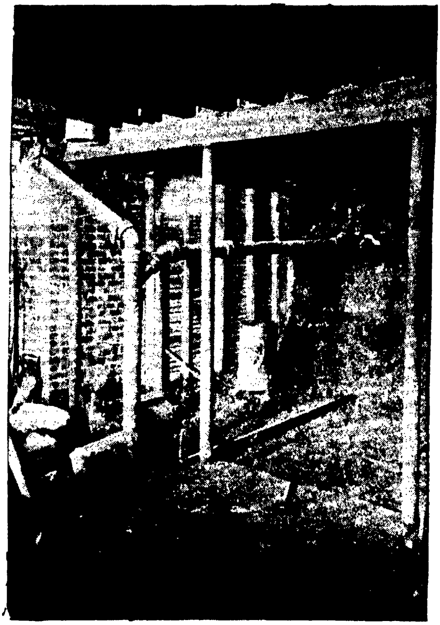


FIG. 39.—Metal posts and girder.

The Frame.—For a frame building a timber called the sill is laid upon the foundation of concrete, stone, or brick, and on this, extending to an opposite foundation wall, or to a girder carried on wooden posts or piers of stone or brick or concrete, are placed, or hung by metal frames, the floor joists, about sixteen inches apart. Upon the sills are erected pieces of lumber called studs, or two-by-fours, from their dimensions two by four inches, which form the framework of the walls. These are spaced about sixteen inches apart and spiked to the floor joists. Openings are left for doors and windows and the frames for these are set in position after the wall finish is put on. At the second-floor line, the studs carry a piece of timber, the girt, which supports one end of the second-floor joists. This is either notched into the studs which continue to the roof line, or rests on top of the studs, with the second-story studs resting on it. The other ends of the second-floor joists rest on a similar piece of timber in an outside or a partition wall, or on a timber, called a girder, carried by posts spanning a space under which there is no partition. At the roof line another timber, the plate, rests on top of the studs and carries the lower ends of the rafters. The upper ends are carried by the ridge pole. This much of the structure is the frame (Fig. 40).

When the girt is merely notched into, or spiked to the studs which run up through two stories, we have the balloon frame. A better frame is that in which the girt is placed on top of the studs, so that these are not continuous through two stories. Braces at the corners and over openings strengthen the frame (Fig. 41).

Sheathing and Lathing.—The sheathing is nailed to the studs diagonally on the outside, to help brace the structure, and the laths are nailed to the studs on the inside. The spaces for doors and windows are not sheathed nor lathed. On top of the joists the rough floor is laid and on their lower edges the ceiling laths are fastened.

Insulation.—This form of construction gives a large number of air spaces in floors and walls which serve to keep the house cool in summer and warm in winter, if they are properly closed, making these spaces dead air spaces and not flues which actually cool the house in winter, and which are also dangerous because of the draft afforded if fire should start. Unless these air spaces are well stopped at each floor level they also provide passage-ways for vermin (Fig. 46). In order to close these runways for fire and vermin, it is necessary to fill in solid with brick and mortar, or a thick layer of mineral wool or similar materials, the spaces between floor joists under a wall or partition which rests on a wall or partition below, and in brick or stone buildings to fill in the same way at each floor line the space between the brick or stone and the plastering. This is a simple precaution, but careless contractors not only neglect it, but sometimes sweep into such spaces inflammable material such as shavings. All draft openings in any part of the structure should be thus fire-stopped (Figs. 42, 43).

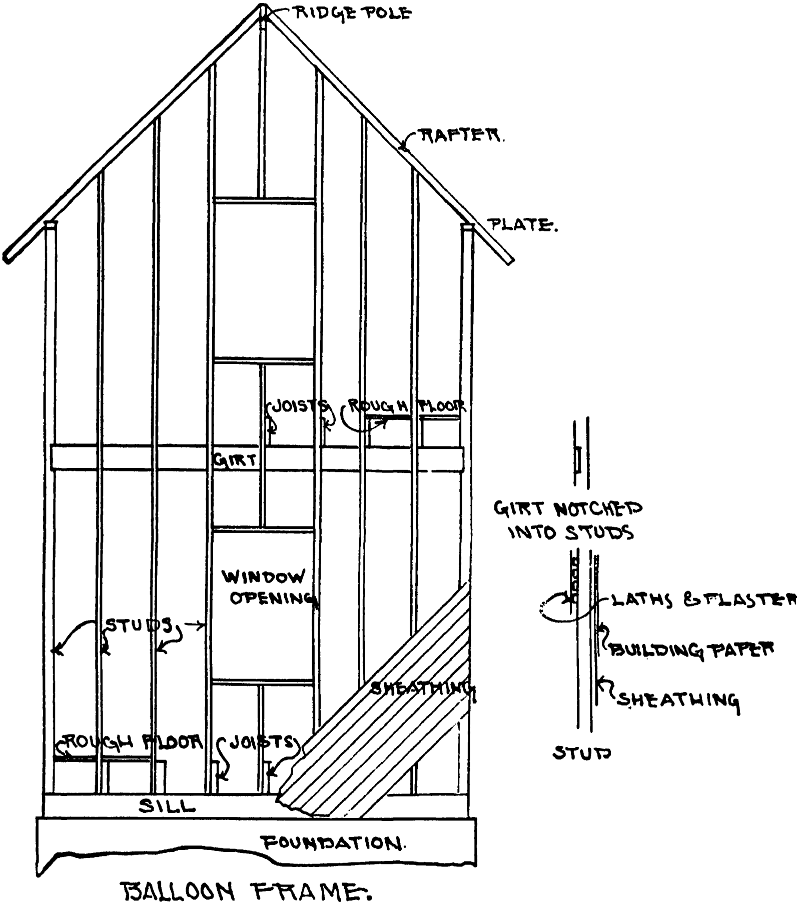


FIG. 40.—Balloon frame.

As further protection from cold several kinds of insulating material are used, paper, felt, and moss, which in a cold climate are well worth their cost in the comfort they insure and the fuel

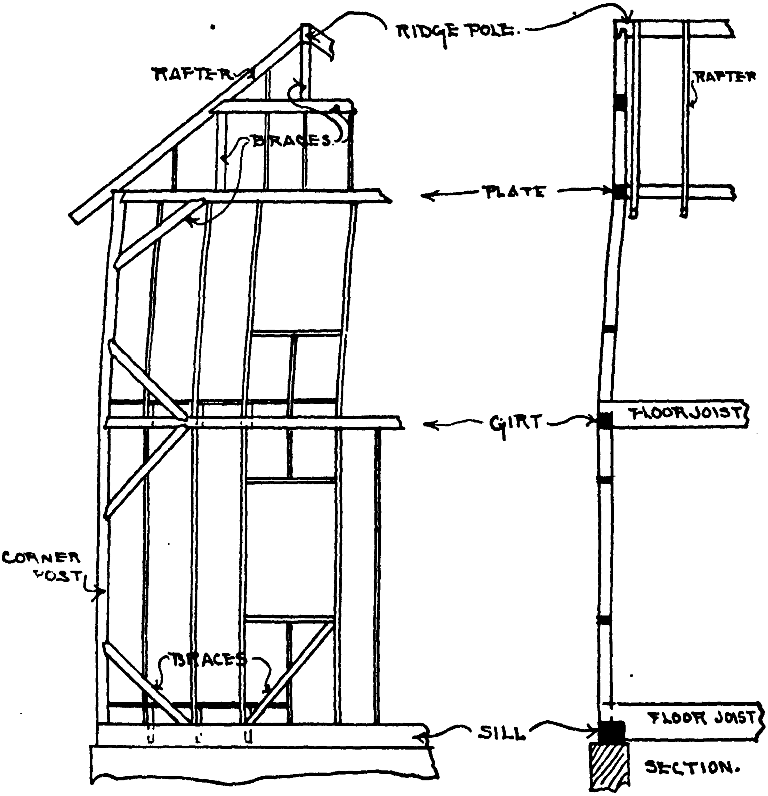


FIG. 41.—Braced frame.

they save. They also help to keep a house dry, and to deaden the noise, and when they are of non-combustible material such as asbestos felt they offer some slight protection against the spread of fire. Floor deadening of cement or sawdust or ashes is used in apartment houses. Even in cheap construction building paper is

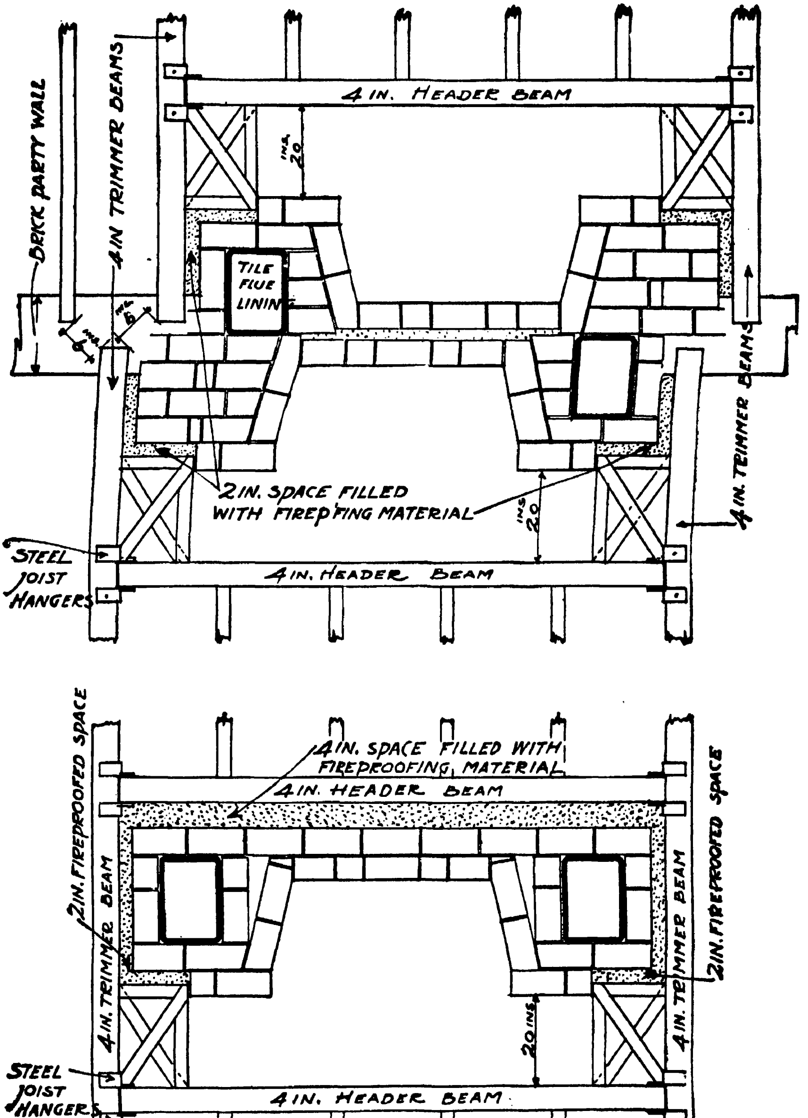


Fig. 42.—Fire-proof fireplaces.

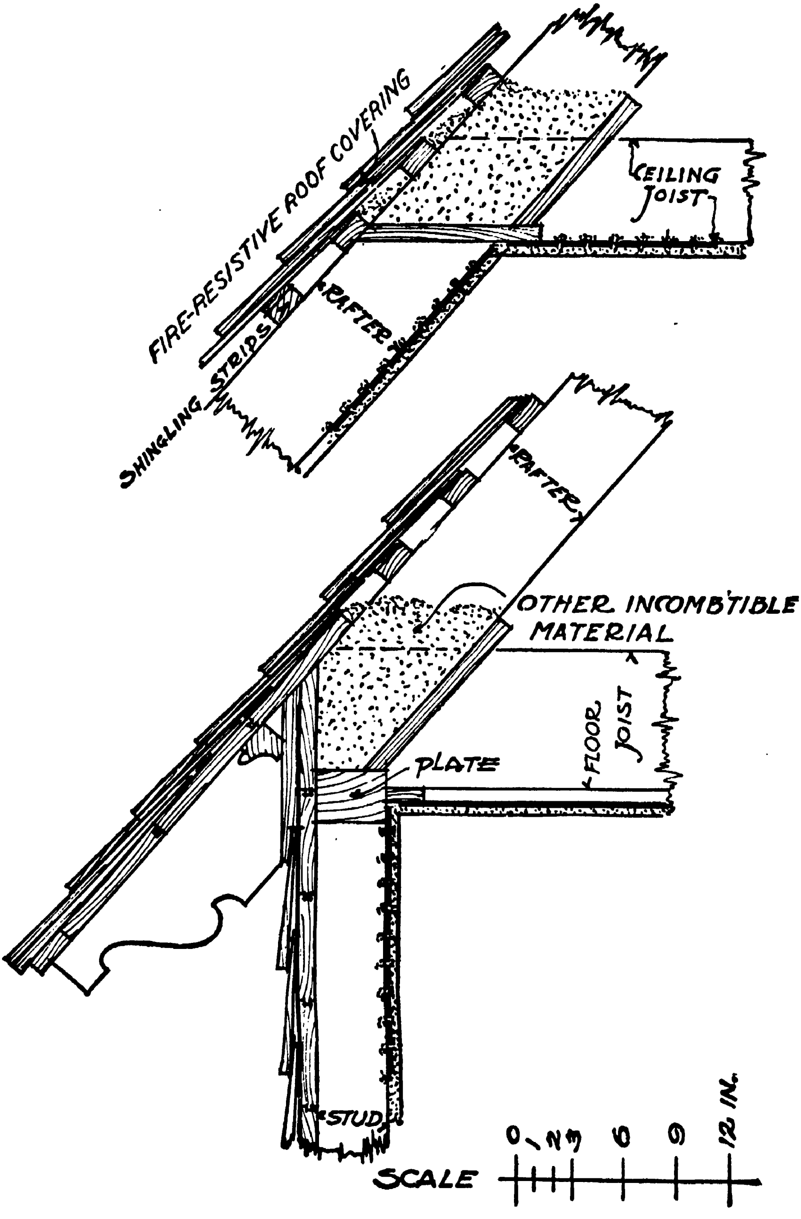


FIG. 43.—Fire-stops at roof line.

tacked over the sheathing and laid under the finished floor. Sometimes the inside part of the exterior covering, the sheathing, is roughly plastered, back-plastering this is called, as a protection against cold and heat and fire (Fig. 44).

Chimneys.—Fireplaces and chimneys may be built as the frame is built, or they may be constructed later in spaces left for them. To secure a good draft each flue should be carried up two feet above the highest point of the roof. The construction of chimneys and flues is very important because so many fires are caused by defective chimneys. The National Board of Fire Underwriters suggests that chimney walls of brick or concrete be at least four inches thick exclusive of linings and that the wall of the chimney where it is exposed be at least eight inches thick. This means that all flues should be surrounded by eight inches of brick, rock or concrete except where two flues are carried up in the same

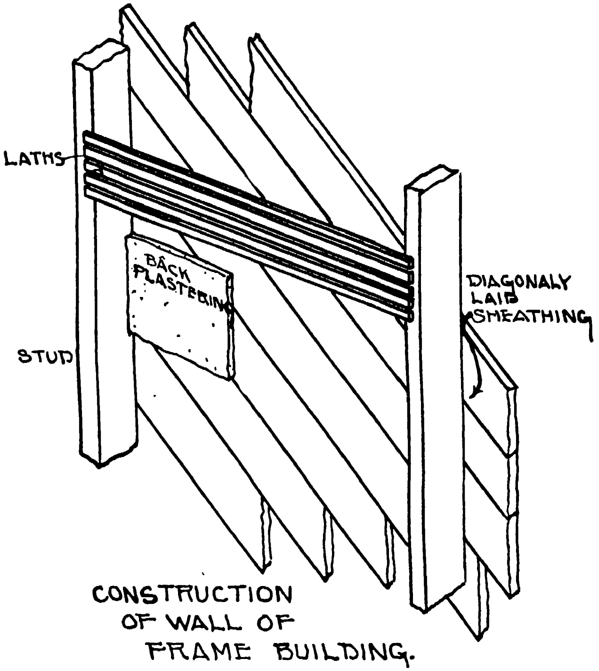


FIG. 44.—Construction of wall of frame building.

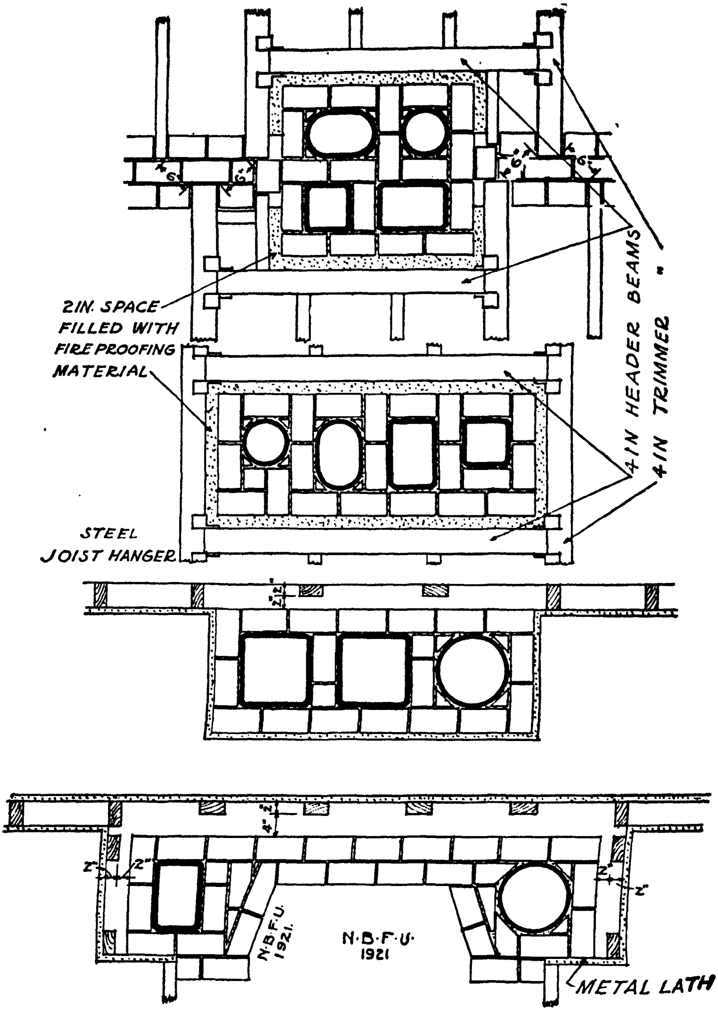


FIG. 45.—Fire-proof fireplace and chimney stacks.

stack, when four inches of brick or concrete may separate them from each other. The proper thickness of stone chimneys depends upon the shape of the stones used. Rubble stone chimney walls

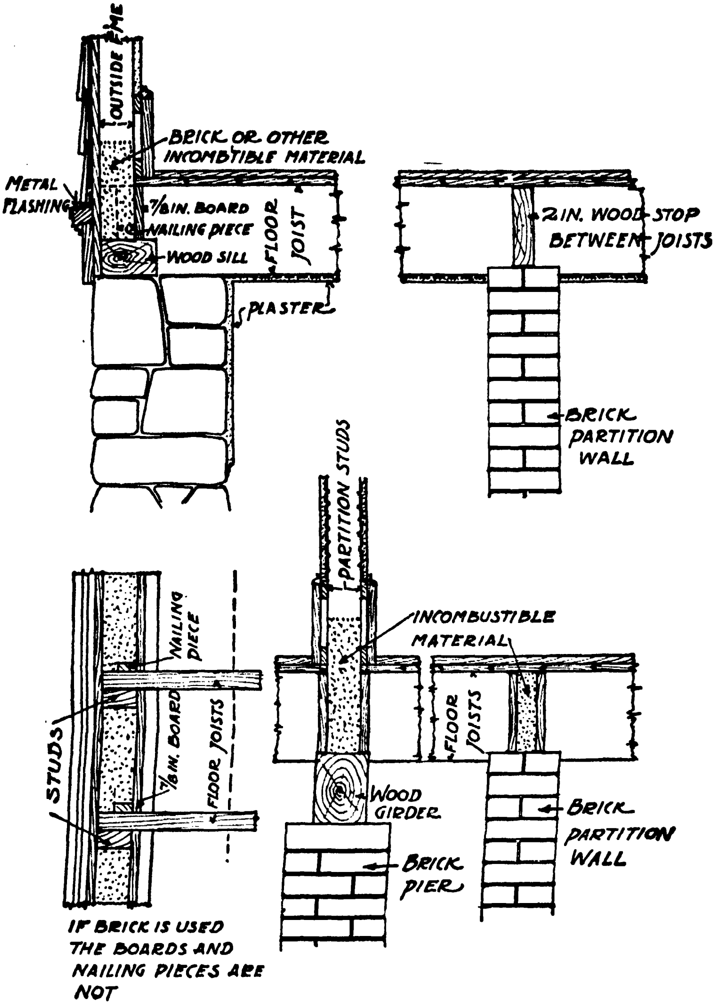
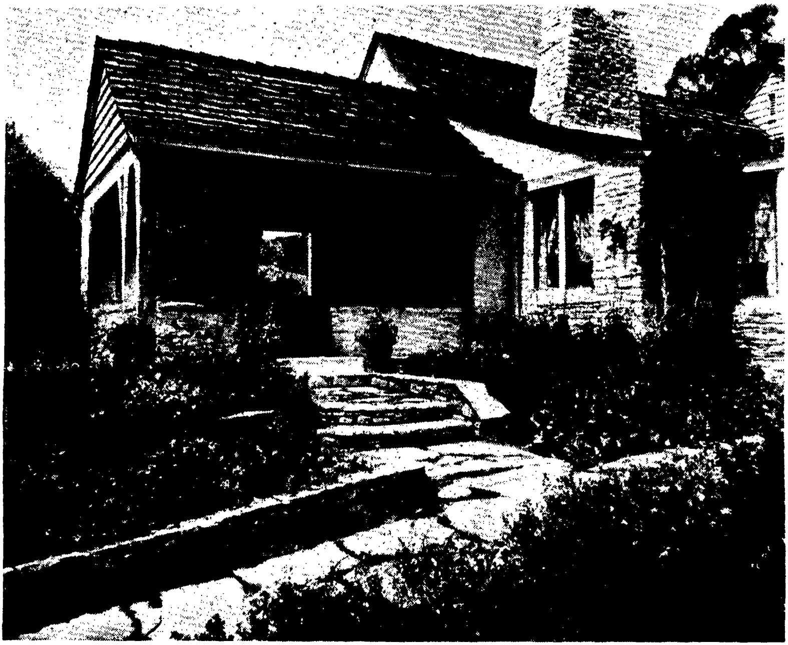


Fig. 46.—Fire-stops.

should be at least twelve inches thick. All flues should be lined throughout with fire clay flue lining or fire brick. The very best mortar should be used in chimney construction and all joints should be carefully pointed. At no place should a timber be allowed to come within two inches of a chimney wall, and the space between the chimney and any timber should be filled with incombustible material supported by metal, to form a fire-stop (Figs. 42-46).

Exterior Finish.—The exterior finish is fastened to the sheathing after the window boxes have been put in place. The commonest wall finish is clapboards, wide or narrow, overlapping each other. Another common and charming finish is shingles which may be lapped to expose a greater or smaller surface to the weather. When the finish is to be stucco, wire mesh or laths are fastened to the sheathing and the plaster applied to this. Since a plastered house is likely to be damper than one finished with clapboards or shingles, some damp-proof material should be used over the sheathing under



Myron Hunt and J. D. Chambers, Architects.

FIG. 47.—A beautiful house with a living porch opening on the garden. The stone of the walks, terraces, and house tie the house and garden together. Note the shake roof.

the plaster, also when the exterior finish is brick, which absorbs moisture, damp-proofing should be used. A brick veneer house properly water-proofed is dryer and warmer than an all-frame house. A single thickness, four inches, of brick is laid against the sheathing, insulating and damp-proofing. The bricks must be tied to the framework by spikes or anchors. The outside trim is next put in place.

The Roof.—Upon the rafters rough boards are laid and fastened, then building paper and in the small house usually shingles. Old-fashioned shakes, thick handcut shingles, make an attractive, durable, and tight roof (Fig. 47). Tile and slate roofs are sometimes used. Tiles and slate are heavy and require more support than the wooden roof, but they protect the house against fire. Asbestos shingles also are fire-proof, they are light as well, cost only a little more than wooden shingles and do not require painting. Tin, and composition roofing are often used. Neither as commonly employed makes a sightly roof, but the fact that composition roofing may be used in an interesting way is illustrated in Fig. 137. Around chimneys and all other openings in the roof, flashing of copper, lead or tin is used to insure a tight roof. Because so many fires start on the roof, fire-proof roofing, such as slate or asbestos, is strongly to be recommended.

Painting.—Shingles are sometimes allowed to weather, that is, they are left unstained and gradually they take on a beautiful silver-gray color like that of driftwood picked up along the beach. Staining preserves them however. They must be dipped in the shingle stain before being put into place to get the full benefit of the preserving effect of the stain. Other lumber should be given a coat of filler promptly to protect it from the weather, and as soon as the trim is all in place, the exterior should be painted. To be kept in good condition a frame house in most climates should be painted once every three years.

Interior Finish.—Chimney breasts may be finished in brick, tile, marble, metal, plaster or wood. Walls are usually plastered although wood panelling and jointed boards are used occasionally. A smooth surface which does not hold dust is best for the walls of service rooms, passage-ways and closets. There are many types of rough-surface plaster finish which give pleasing effects. A composition material which can be nailed to the studs is sometimes used in cheap or temporary work instead of laths and plaster. All flues must be built, and the roughing in of the plumbing and the wiring for electricity must be done before the interior is plastered. After the plastering is done, plumbing fixtures, lighting fixtures, and the inside finish, door and window trim, skirting or baseboard, panelling and stairrail are put in place. The finished floor is laid when the building is nearly completed.

FIG. 48.—Lathing.

Plastering.—Upon the inside of the studs and the lower side of floor joists are nailed laths, thin and slender strips of wood, to hold the plaster (Fig. 48). Instead of wooden laths we may use metal lath or plaster board, both of which make the house more fire-resisting than when wooden laths are used. Plaster is usually applied in three coats, the first, the "scratch" coat, the second, the "brown" coat, and the third, the "finish," "hard" or "white" coat.

Trim.—Doors, door and window frames, and baseboards, stair steps and stairrails are usually of wood, although they may be had in metal. In expensive houses we find mahogany, walnut, redwood, maple and oak; in cheaper houses we find birch and ash and pine. These woods may be varnished or waxed, and the cheaper ones we frequently find stained to imitate a more expensive wood or painted. Ornamental tile is sometimes employed around doors and windows which have metal frames, for stair risers, and if there is a tile floor, for the baseboard.

Floors.—The question of floors is probably the most difficult to decide. We want floors which are sanitary, non-absorbent and the joints of which are tight, floors which will stand hard usage, look well, be comfortable to walk upon, which do not require too much labor to keep them in good condition and which are not expensive. Tile floors satisfy all these conditions except that they are not comfortable and are expensive. Smooth finished stained cement is used for kitchens sometimes, but the cook may complain that it is cold and hard although it is commonly used in office buildings and laboratories without being a cause of complaint. House-keepers demand resiliency for their floors and a material which one may walk upon noiselessly. The rubber or corklike composition used for hospital corridors and elevator floors answers these requirements and it comes in varied colors but is rather expensive. Wood does not wear very well and it is difficult to keep in good condition. Mahogany, oak and maple are the best woods for floors; birch comes next. Pine, Douglas fir and Western hemlock make durable floors, although they are not so attractive as the first-mentioned woods. All flooring wears best when the boards are cut across the grain, that is, quarter-sawed. When cut with the grain the floor splinters easily. Wooden floors may be scrubbed, oiled, waxed, varnished or painted, or covered over with fabric. Bare wood floors, no matter how finished, require daily care to keep them in good condition. Nevertheless, wood is by far the

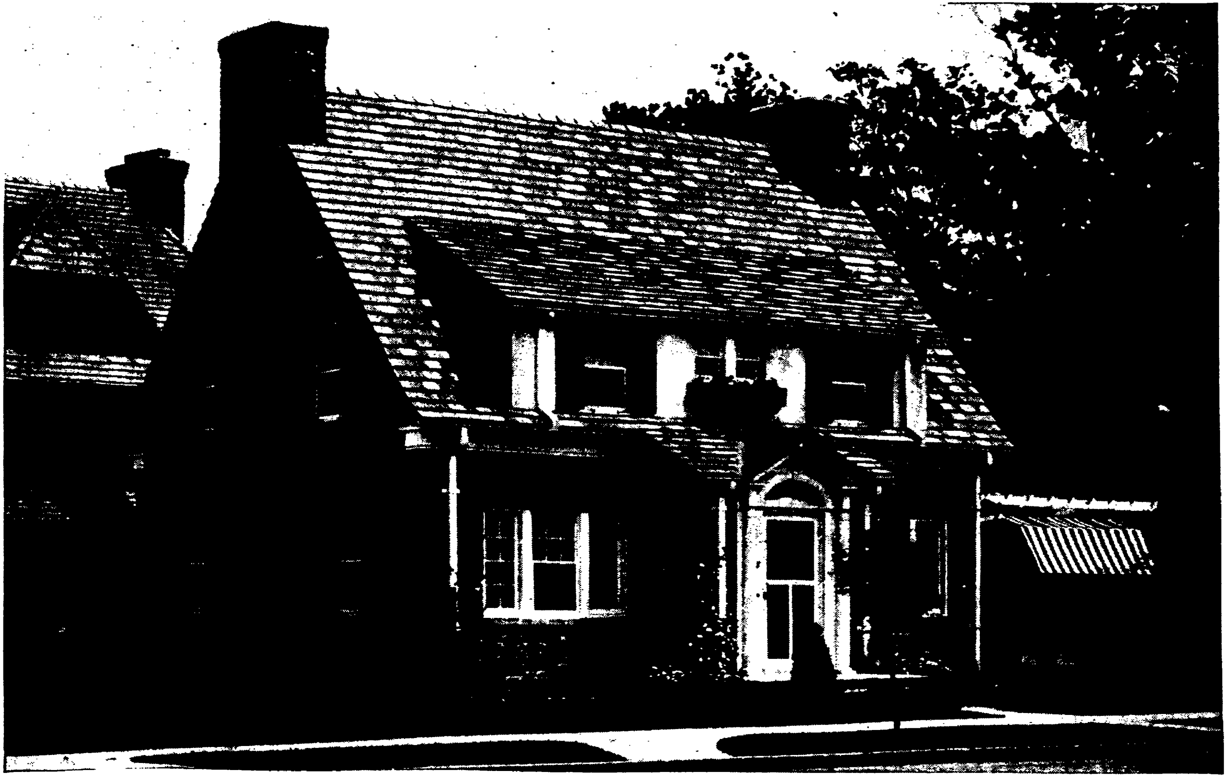


Fig. 49.—A brick house of Dutch Colonial design. This exterior promises a comfortable compact interior.

most commonly used material except for bathroom and laundry, where tile and cement are often employed. The best floors are the cheapest in the end.

Good Building.—Good building depends upon the quality of the materials used, their adaptation to the purposes they serve, and the workmanship employed in putting them together. Practically all the materials come in many quality grades, and some of them in standard sizes as well. The quality and size should be chosen according to the work to be done. The highest quality is not always necessary and when used unnecessarily is a waste. Paint, concrete, mortar, and plaster are mixed according to various formulae; the one chosen should in each case depend upon the function of the product. The various parts of the house are bound together usually by mortar, anchors, bolts, and nails. The size of the latter and the number used are important items in the stability of the house. A house built of materials of poor quality, with supporting members which are too small, the parts of which are not properly fitted and tied together, may appear to the untrained observer to be as good as a better-built house, but time or examination by an expert will prove it is not. We want reasonably well-built but not over-built homes. Some items important in one place are not in another. The local architect knows local requirements.

The Brick House.—Brick houses, as a rule, are built with first-story walls twelve inches thick (Fig. 49) and second-story walls eight inches thick, but many cities permit eight-inch walls for both stories. For houses for working people, the saving, which may amount to several hundred dollars, is important. The U. S. Department of Commerce is endeavoring to determine what should be the minimum in many such matters as this, in order to reduce building costs. If brick walls are the same thickness through two stories, metal joist hangers are used or the ends of the joists are built into the wall. There may be one or two brick partition walls, but usually interior walls are of frame construction. Into the inside of the brick wall are built strips or blocks of wood called furring strips or furring blocks to which are fastened the

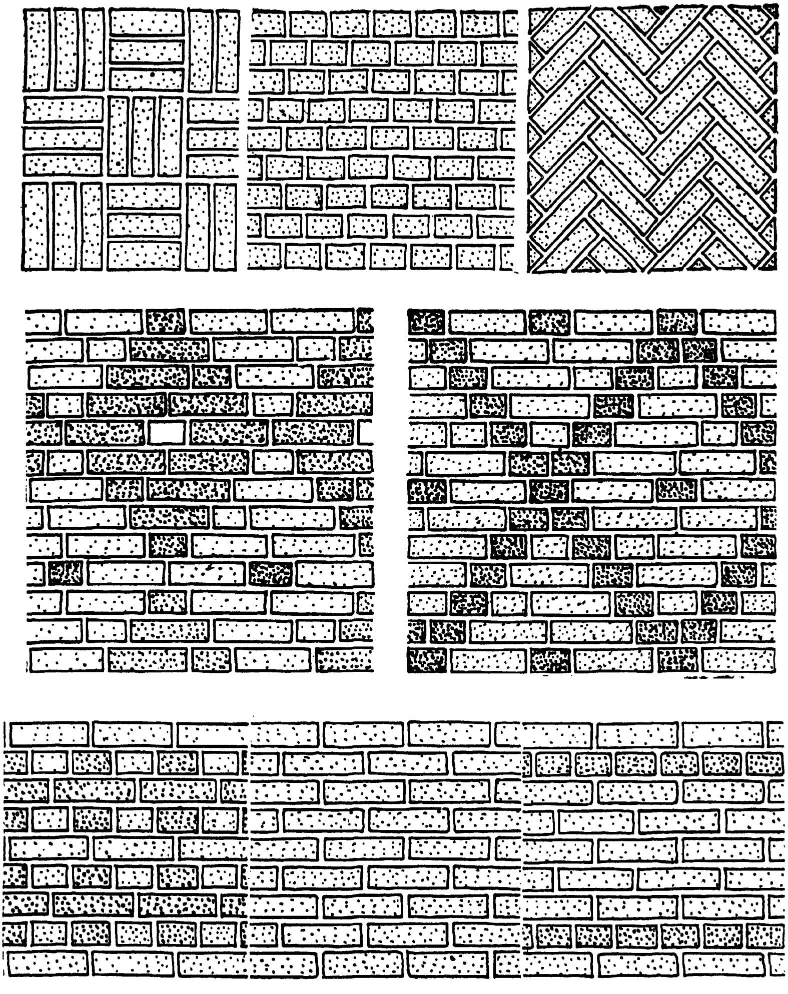


Fig. 50.—Brick bonds. Note how patterns may be brought out by using bricks of different shades or textures, or by projecting some bricks beyond the surfaces of others.

lathing for plaster, door and window frames, and the interior finish. The plaster might be applied directly to the brick, but brick absorbs moisture and this would penetrate the plaster, spotting it if there were not an air space between. It is also well to paint the inside of the brick wall with water-proofing as an additional safeguard against dampness. The bricks may be laid with different bonds, which are different arrangements of headers and stretchers, that is, bricks with an end exposed and bricks with a side exposed, with different thicknesses of mortar at the joints, and of different kinds of brick (Fig. 50). We have consequently an almost endless variety of brick work. The construction of the stone house is similar to that of the brick house (Fig. 51).

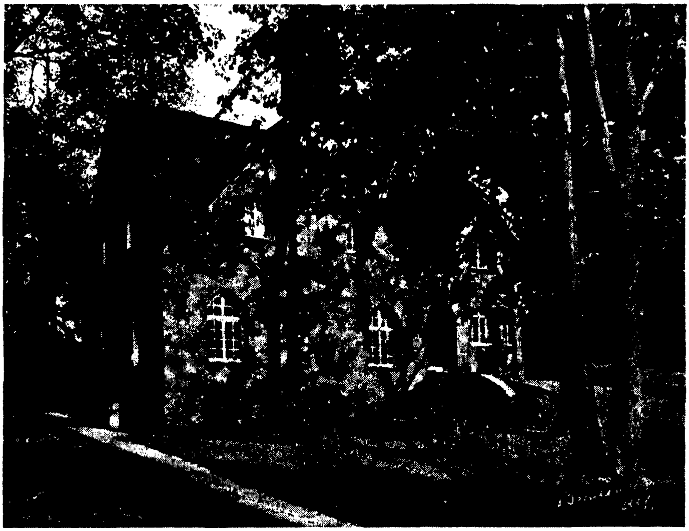
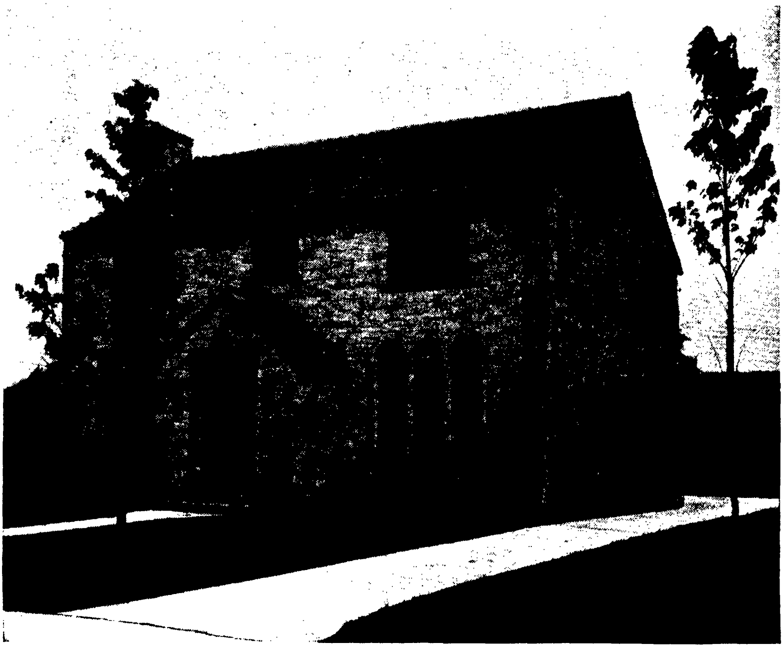


FIG. 51.—A stone house. The roughly cut stone, the few but large openings and the plain gabled roof with its one large dormer and its one smaller one are well suited to each other. The pointed windows echo the roof lines and give an individual touch to the house. The solidity of the building material and the straightforward, appropriate design suggest a substantial, comfortable home.

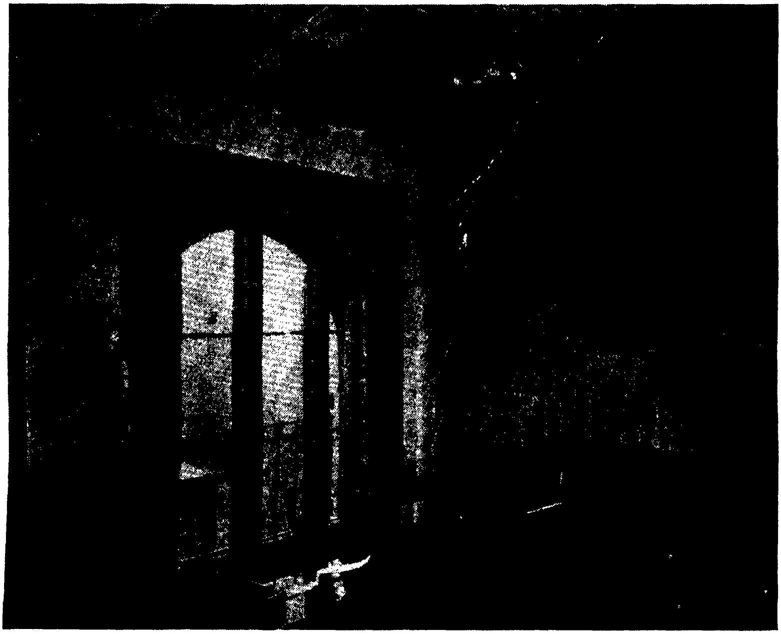
Fire Protection.—Such houses as these, frame, brick, and stone, with inside walls and floors of wood, are inflammable, the brick and stone will not burn, but the whole interior of the house may, and with only bare walls standing, and these often injured, the loss is almost complete. Brick or stone walls reduce slightly the fire danger, but most fires originate within the house, or on the roof. A fire-proof roof is therefore additional protection. A fire-proof house of brick or stone may be built using reënforced concrete floors, or hollow tile floors, and with inside partitions of brick, stone, tile, or wire lath and metal studs.



Courtesy Portland Cement Association.

FIG. 52.—A concrete block house with machine-made tile roof. The blocks are laid in random ashlar bond.

The concrete house also is fire-proof. There are three types of concrete houses, the concrete block house, the precast, and the monolithic or poured house (Figs. 52, 53, 54, 56). The precast house is built by making units of concrete for walls and floors and tying these together (Fig. 56). The units may be made in one place and shipped to other places where they are put together. Using the same units, some variety may be had by varying the number used and their arrangement. The monolithic or poured house is constructed by setting up in place forms which are filled by pouring in a wet concrete mixture, just as foundations are built. Edison devised metal forms which may be quickly set up and are used over and over again. It is possible as a regular thing to set up the forms for a six-room house and to pour it in five days. For the single house the concrete block is best, but when a large number of houses are to be built the precast or the monolithic houses are cheaper and more quickly built. The concrete house, as a rule, costs more than frame, the cost of each varying with the locality, but the fact that it is fire-proof and more durable than frame, outweighs its greater cost.



Courtesy Portland Cement Association. W. L. Risley, Architect.

FIG. 54.—Interior unplastered walls built of concrete blocks. Tile floor.

Concrete Block and Hollow Tile Houses.—Concrete blocks are very strong and durable and easily handled. They are waterproof, vermin-proof and because of their air spaces make a house

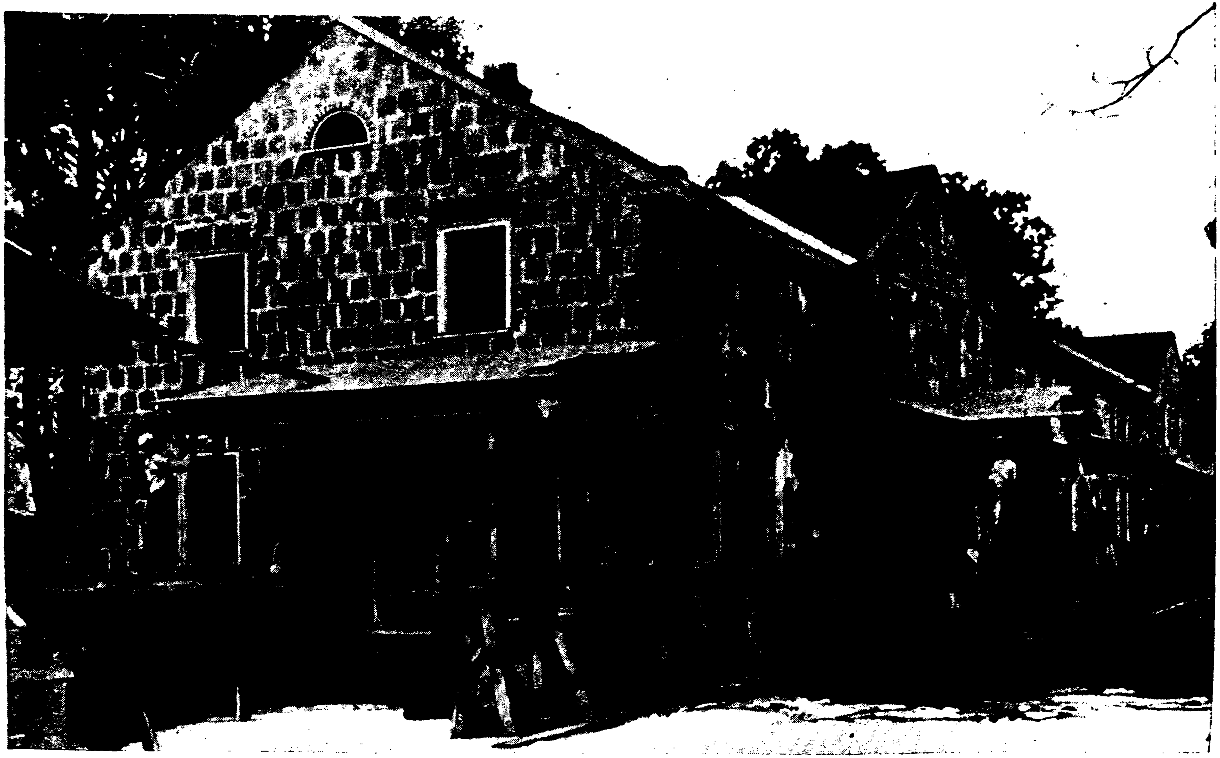


FIG. 55.—Hollow tile house under construction. This house will be covered with cement plaster.

cool in summer and easy to heat in winter. The same is true of terra cotta tiles which are used for building. The tiles come in several sizes and shapes (Fig. 55). Outside walls are usually built of tiles twelve by twelve by eight inches, inside partitions of much thinner ones. Supporting floors are built of tiles, concrete and steel reënforcing rods. On top of this run the pipes for gas, water and wires, imbedded in concrete filling, on which the finished floor is laid. Such a floor is easy to build, firm, fire-proof, and sound-proof. The plastering both outside and inside is done directly on the concrete blocks or tiles.

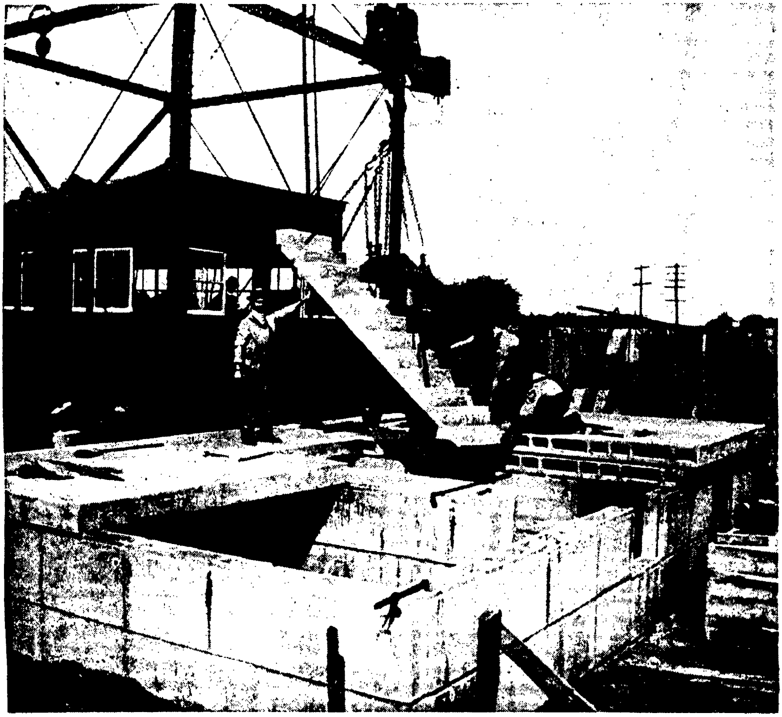
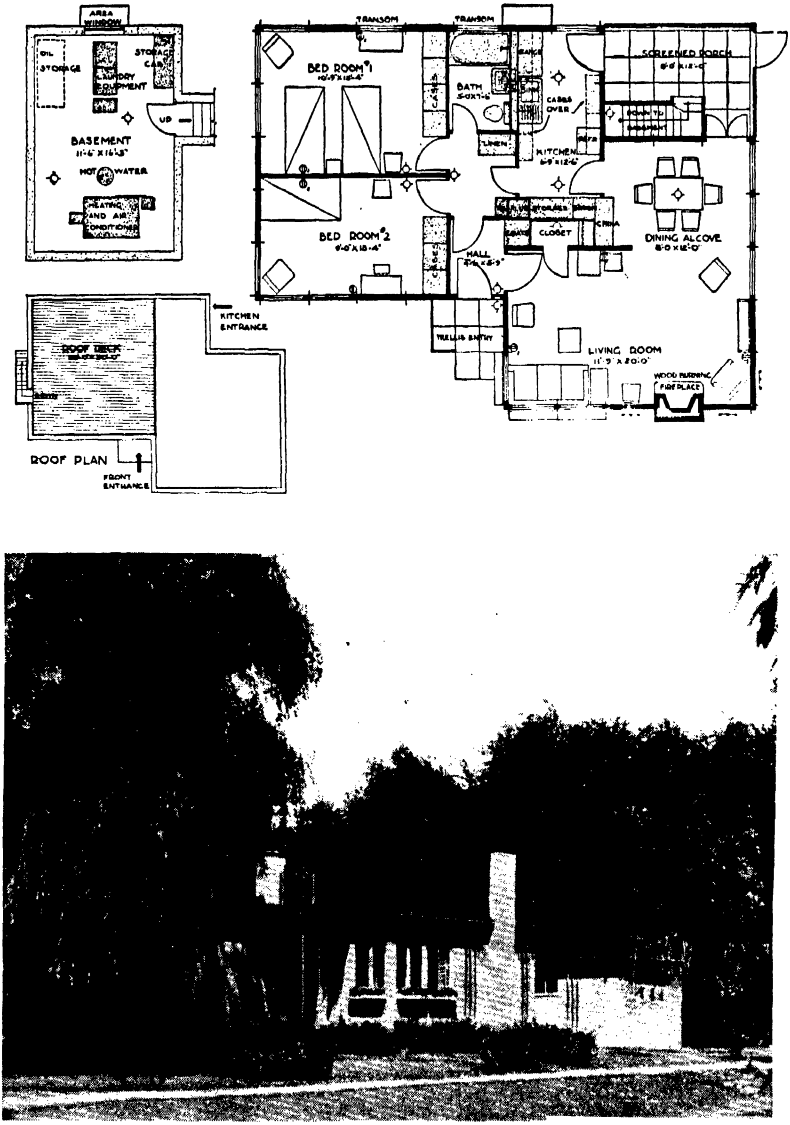


FIG. 56.—A precast concrete house under construction.

The Steel House.—Steel may replace wood for the frame-work of the house. When the exterior and interior finishes of the walls, the roof, and the floors are of incombustible material we have a fire-proof house. A considerable number of such houses



By General Houses, Inc. Howard T. Fisher, Architect.

Fig. 57.—View and plans of a pre-fabricated steel panel house in Elmhurst, Illinois. Notable features are the flat roof with living and recreation deck, the one-piece chimney panel for the fireplace, corner windows, and the general simplicity of the entire structure.

have been built but they are more expensive than frame houses. Another type of steel construction is called frameless steel or cellular steel construction. Walls, floors, and roofs are built of thin sheets of steel folded into a series of V's or into a series of shallow rectangular U's. These shapes give strength and rigidity to the structure beyond that supplied by flat metal of the same weight. No frame is required and the parts are welded or bolted together.

Newer Methods of Construction and Materials.—There is a movement toward an improved building technique based on factory fabrication of standardized parts which may be fitted together on the site with a minimum of time and labor. In the factory, work can be done more easily than on the site through making better use of machinery and being less interrupted by weather conditions. Unless pre-fabricated parts are made locally and largely of local materials their use will be limited by the cost of shipping.

It has long been customary to use pre-fabricated window frames, doors, bathroom medicine cabinets, and similar items. In addition to these we now have wall, floor, and roof panels or units. Some of the wall panels are plain, others contain doors, others windows, and others, fire-places. We also have units such as closets, cupboards, and stairways. Various materials have been used for the panels and other units, among them steel, wood, pre-cast slabs of concrete, gypsum, and synthetic materials, and combinations of these. The panels may be finished or unfinished and insulated or uninsulated. These units still permit of individual design within limits and houses built of them can be assembled in a comparatively short time (Fig. 57).

There is a variety of finishes and of heat and sound insulating materials used in these newer types of construction. Glass and some of the synthetic materials are self-finished. Other materials may be surfaced by old fashioned paint, new resin compositions, porcelain enamel, or something else. In some cases the finish is attached to an underlying support. Old materials are employed in new ways, and new synthetic materials have been developed which are improvements in building. Glass is used in the shape of blocks and slabs for walls, floors, and roofs as well as for windows. Canvas treated with water-proofing and preservative is being experimented with for use as outside and inside finish.

In the V. D. L. Research House illustrated in these pages many new building materials are tested under conditions of actual use (Figs. 29, 63, 79, 133, 134).

Technical Knowledge Necessary.—Besides the technicalities indicated in the above discussion, there are many other details which the architect and builder must consider. Brick courses must be arranged to fit around windows and doors and wiring for electricity must be done in a way prescribed by law. The proportions of the materials for cement and mortar, the sizes and grades of materials, must all be specified. The contractor understands these matters, but unless there is an architect to protect the builder, the contractor often takes advantage of the latter's ignorance to use inferior materials and to do poor work. The architect is, or should be, not only an artist but a master of all the building trades as well. Sometimes we find this combination in one man; more often it is formed by partners in a firm; or the architect is one of these and employs the other, the designer or the superintendent. At least one member of the firm should be a good business man, and both should be fair and just in all their dealings.

PROBLEMS

1. Note the various wood finishes of frame houses you see in your neighborhood. How are corners finished? What is the finish at the roof line and at the top of the foundation? Repeat for brick and stone houses.
2. Notice different roofing materials on the houses in your town. Count the number of each.
3. Visit houses in process of construction and locate all the points of the frame mentioned. Find the places where fire-stops should be put.
4. Visit houses being built and study the chimney and flue construction. In completed houses look for flashings around the chimneys.
5. Look up the dwelling house classification according to construction which insurance companies make. Find out insurance rates for the different types of dwellings. Why do some cities have better insurance rates than others?
6. Get catalogue from a mill and look up the different stock designs of millwork.
7. Look up different types of floor finishes, talk with people who care for them, and write out what finishes you prefer for the different rooms of your house and why.

CHAPTER VI

PLUMBING

A plumbing system is for the purpose of supplying water to different parts of the house and for removing household waste. It may be merely a pipe carrying spring water into the kitchen and another pipe conducting waste water, or used water, out of the house. It may be a complicated arrangement of pipes, pumps, storage tanks, heating devices, and fixtures of many kinds.

Three Essentials.—The first essential for a plumbing system is an adequate supply of water under pressure to carry it to all outlets, the second, proper fixtures, and the third, some system for the disposal of sewage. In the city with water works and sewer system the householder merely connects his house with them. In the country the problems of securing water supply and of disposing of the household wastes are more difficult.

Water Supply.—Water used for household purposes should be drinkable and soft, and free from substances injurious to health. It is not always easy to find water with these characteristics, sometimes it is impossible, but in such cases there are ways of remedying the defects. Absolutely pure water is to be found only in the laboratory. The moisture of the air as it condenses and falls, gathers from the air impurities such as water-soluble gases and particles of dust, organic and inorganic. This same water when it falls on any surface gathers still more impurities, among which organic material will be found. As rain water filters through a sandy soil, suspended matter is gradually eliminated from it, but it still contains soluble matter. As water is freed of organic impurities by filtering through the earth, its content of mineral substance in solution increases, being accumulated on its course, thus making it likely that water from deep wells will be hard water.

"Hard" water is not only for many purposes disagreeable to use but it is injurious to parts of the plumbing system. When water containing lime in solution is heated, some of the mineral is deposited upon the pipes or the boiler. Hard water may be softened by chemical treatment. There are satisfactory domestic water softeners which the householder may install.

The impurities which make water dangerous to health are chiefly organic impurities; whenever we have these we have bacteria, many of which are harmless, of course, but some of which are responsible for serious diseases. It is a difficult matter for a city to secure a water supply which, without treatment, may be safely used for drinking purposes. Many cities purify by mechanical or chemical means the water which otherwise would be dangerous. When this is not done the house-keeper may make dangerous water innocuous by boiling it for twenty minutes. In the country or in small towns when there is neither water nor sewage system great care must be exercised to secure safe water.

All safe water is not palatable. Some of it contains matter which gives it a very unpleasant taste. Such water may be taken as medicine, but it will not do for household supply. Sometimes by treatment, the disagreeable taste may be removed.

Sources.—We may draw our water supply from the falling rain which we collect in cisterns, or from surface water, that is, rain water which has collected in streams, ponds, or lakes, or from underground water, that is, from springs or wells. Wells may be shallow, tapping water which has not percolated through enough filtering material to thoroughly purify it, or they may be deep enough to reach water which has been well filtered.

Springs.—Spring water is popularly supposed to be wholesome; this is not always the case. The water may not have filtered through enough sandy ground to have been freed from all organic matter, or at the surface, or on the way to the surface, the water may have received fresh contamination. Springs in thinly settled regions unless polluted at the outlet are generally sources of wholesome water. A spring should be fenced about or covered to keep out animals and refuse.

Wells.—Shallow wells are another popular source of supply. These are either dug and lined with brick or stone, cement, or some other material, or they are driven, that is, a pipe is driven down to the source of supply. A well is not "deep" unless the water is found only at a depth of some hundred feet or more. The water from deep wells is likely to be organically pure and so safe for drinking unless in a limestone soil where fissures permit contamination to travel a long way, but the water from shallow wells is more likely to be polluted from some nearby source.

In locating a well or in choosing a spring, either should be so situated that sources of pollution will not drain into it. A well or spring is not always safe when it is on higher ground than a neighboring cesspool or barnyard; sometimes the direction of the slope of the subsurface formations is such that the water flowing underground is forced up from a low point to a higher one. Sometimes pumping a large quantity of water from a well changes the conditions of the underground flow, the more water pumped out the wider the area from which this water is drawn and therefore the greater the danger of contamination. Because of changing conditions all water supplies should be frequently tested to ascertain their condition. When the water in a spring or well is pure at its source it is often polluted by the entrance of organic matter from the surface, which is washed in or falls into the water. Dug wells should be protected by water-tight covers tightly joined to the well curb above the surface of the ground.

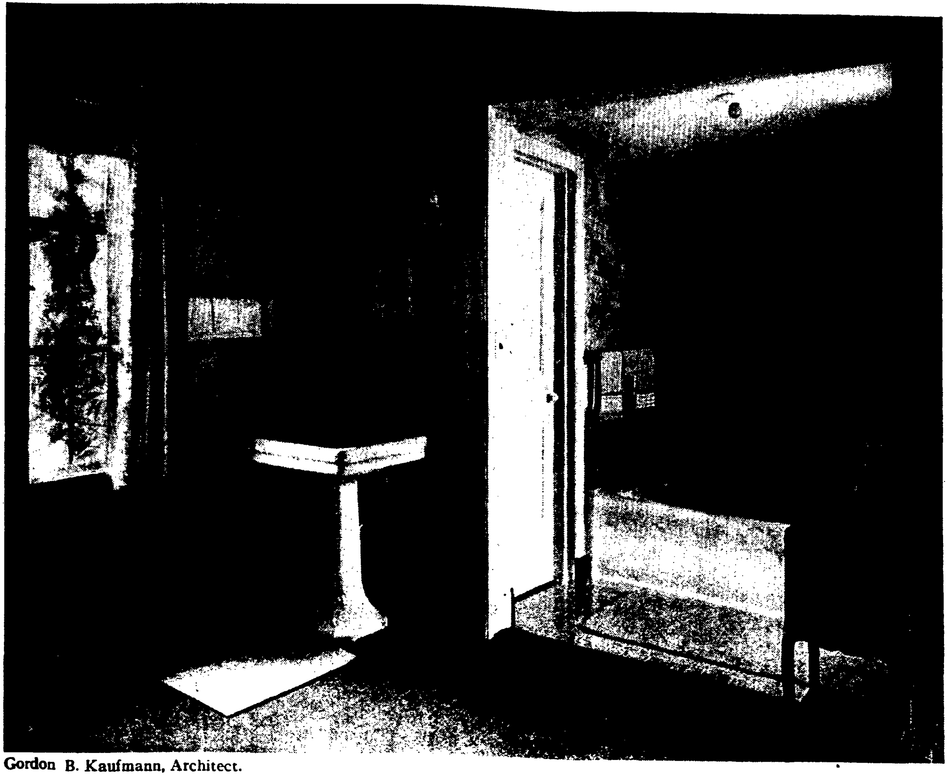
Cisterns.—Rain water stored in cisterns is another common form of supply. Rain water is safe until it gathers organic impurities from the surface from which it is collected. Roofs from which water is collected should be so built that they will not afford lodging places for dead insects and birds and their excretions and other organic waste, and it should be possible to wash off easily and quickly the unavoidable collections of such things. The first rain which falls, washing from the roof dirt and dust, should not be allowed to enter the cistern at all, and it is well to run the rest of the water through a filter bed of sand and gravel near the cistern before turning it into a storage tank. The storage tank in which cistern water is kept should be tight to prevent the entrance of foreign matter and it should be as carefully protected from surface pollution as springs and wells should be.

Water Works.—When an adequate supply of good water is available the next step is to get it into the house. Pressure is required for this. In cities the municipal water works supplies this pressure. Where the householder installs his own water system he has a choice of several methods of securing pressure. When the supply is situated at a point higher than the house to be supplied gravity may be depended on for the distribution of the water. Usually the supply is lower than the house in which the water is to be used, in this case we may choose between the elevated tank, the hydro-pneumatic and the pneumatic systems.

Elevated Tank System.—With the elevated tank, distribution from the tank is by gravity and some form of pump is required to raise the water to the tank. The water may be pumped up by hand, by a gas engine, by an electric motor, by a windmill, or in some cases by the hydraulic ram. This last may be used only where there is a stream furnishing suitable water or some other large supply of water which can be made to flow over the ram. The ram is so devised that a small portion of the water flowing through it is by energy furnished by the flowing water raised to a desired height. Until the ram wears out it operates without stop or as long as the stream flows. With the double-acting hydraulic ram one supply of water may be used to pump water for storage from another source.

The tank may be of metal or wood or concrete; it must be large enough to supply the household needs and placed high enough to give the desired pressure. The tank may be located in the house or out of doors. Each location has points in its favor and points of disadvantage. An out-door tank may be large enough to supply not only the house but barns and stables as well. A tank holding enough water for these purposes must have strong supports, and it would be a difficult matter to arrange for supporting such a tank in an ordinary house. The out-door tank usually does not add to the beauty of the surroundings. The water in the indoor tank is not so likely to freeze; on the other hand there is danger of leaking and consequent spoiling of plastering and furnishings. When the in-door tank is filled with cold water the condensation which occurs on the outside of the tank sometimes does as much damage as a leak. Sometimes the tank may be advantageously located in the barn.

Pneumatic System.—The hydro-pneumatic system has several points of superiority over the elevated tank system. It costs a little more to install, but the repairs are less than in the other system, there is not the danger of leaking which there is with the elevated tank and there is no danger of the water in the tank becoming



Gordon B. Kaufmann, Architect.

FIG. 58.—A combined dressing room and bathroom. This bathroom is in the house the plan of which is given in Fig. 114. Note the varnished wall-paper above the tile in the tub alcove.

contaminated by dust and dirt. When the pneumatic tank is properly located the water in summer is cooler than when it comes from the elevated tank, and in winter there is no danger of freezing. It may be placed in the barn, under the ground, or in the cellar of the house (Fig. 59). Pressure is obtained by pumping water into the tank previously filled with air for which there is no outlet. This compresses the air, and when the air is compressed to one-fourth its original volume it gives a pressure of forty-five pounds. This pressure is ample for the ordinary house. It is necessary to carry excess pressure when the tank is nearly full of water so that there will be sufficient pressure as it empties to carry the water to the highest outlets. Water absorbs air under pressure and there is a constant loss of air which loss must be made good by pumping in new air occasionally. The correct amount of air may be maintained by an automatic air valve and a pump that pumps in air and water at the same time. An automatic arrangement may be used with mechanical pumping power to start pumping when the pressure has fallen to a certain point and to cease pumping when the pressure reaches a certain height.

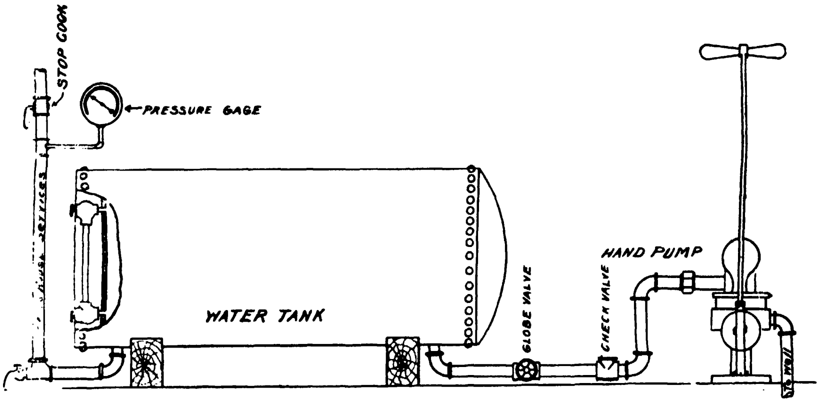


FIG. 59.—Diagram of pneumatic system. University of Missouri Engineering Exp. Station.

Water stored in a tank loses its freshness, so an improvement on the pneumatic system is an arrangement in which the tank contains air only under one hundred pounds pressure, and this air is carried to a pump in a well (Fig. 60). This pump is automatically started by the opening of a faucet anywhere in the system, thus giving a constant supply of fresh water. With one such air tank several wells may be used which is an advantage when there are different kinds of water used for various purposes.

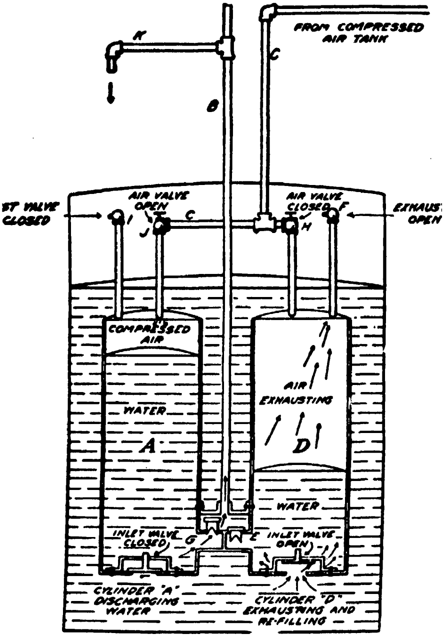


Fig. 60.—System by which fresh water from a well is used for house supply. Compressed air from a tank through pipe C. forces water from chamber A. or chamber D. into house supply pipe B. As A. is being emptied of water, B. is being filled. U. S. D. A.—Office of Exp. Stations.

Amount of Water.—In determining the size of any container for water storage we must consider several things: (1) The daily needs of the family, (2) the water available at different seasons, (3) the power used for pumping. It has been estimated that each person on the farm requires, for all purposes, from ten to twenty gallons per day, the larger quantity when there are bath tub and water closet installed. Cities furnish a much larger quantity than this, but some of it is used for street cleaning, for power, and for fire protection. In parts of the country where the rainfall is unevenly distributed throughout the year, where there are long seasons of drouth, more water must be stored than where the rain occurs frequently and wells never go dry. Where windmills furnish the only power for pumping, water must be stored when these are working to provide for the times when they do not work.

The water supply for all its fixtures is brought into the city house through a pipe connecting with the street main (Fig. 61). In all houses, city or farm, at the point of entrance of the supply pipe to the house, there should be a stop-cock and drain-cock for shutting off the water and draining the pipes whenever repairs to the plumbing system are necessary and to prevent the danger of freezing and pipes breaking when the house is closed in winter. This arrangement is useful also in very cold weather even when the house is occupied.

Fixtures.—The second necessity for a first-class plumbing system is non-porous fixtures set open in well-ventilated and well-lighted rooms, with the proper supply pipes and waste pipes. Annoyance and in the end expense are saved by having fixtures of the first quality. They need not be the most elaborate or the most expensive. Wash-basins, dental lavatories, water-closets, and sinks which are hung from the wall and tubs built to the floor make cleaning easy (Figs. 58, 62, 63, 67). Water-closet bowls are of porcelain; the tanks may be of porcelain or enamelled metal. The tank may be exposed or concealed but accessible for repairs. Wash basins and tubs are of porcelain or more frequently enamelled ware. Sinks are of enamelled ware or of metal. Lemon juice and similar acids roughen and destroy the glaze of ordinary enamel but there is an acid-proof enamelled ware called vitreous or porcelain enamel which ought to be used for sinks, at least, and is desirable for the other fixtures. Porcelain and enamelled ware come in a wide variety of colors and shades and all of the fixtures in many stock sizes and shapes. The faucets are as a rule plated with brass, nickel, chromium, or even the precious metals.

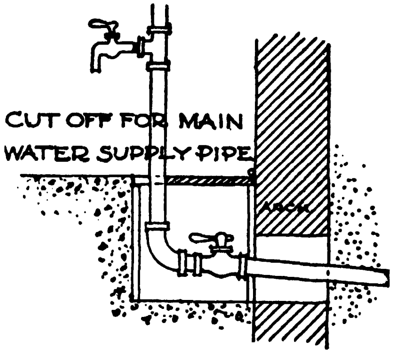
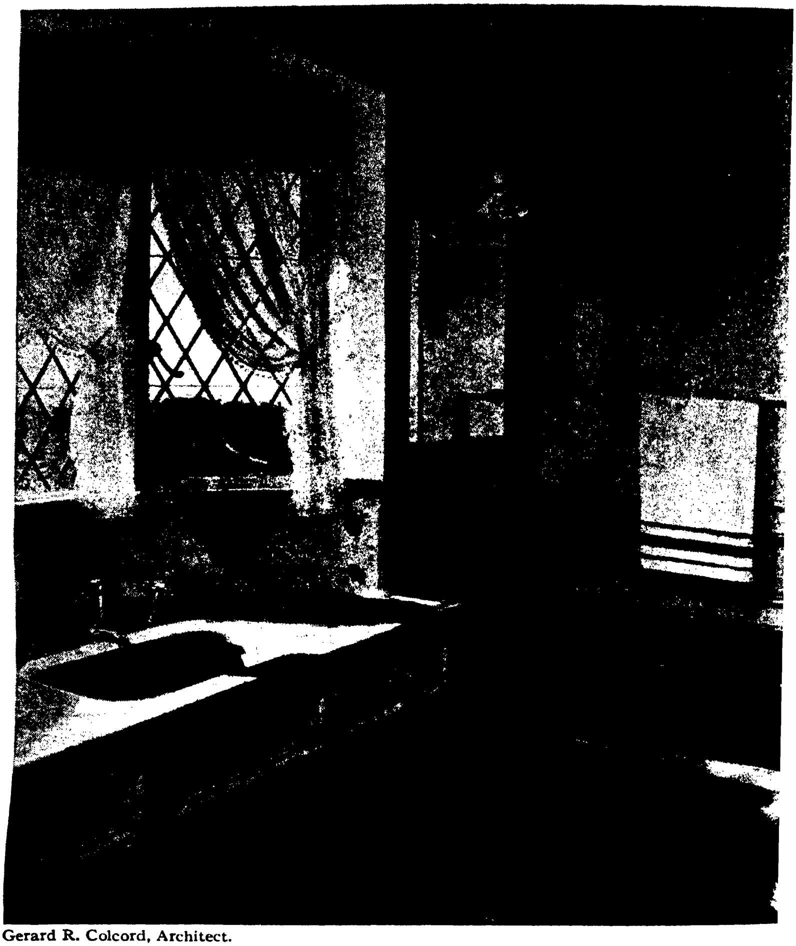


FIG. 61.—Stop-cock and drain-cock where main supply pipe enters the house.

Water-closets of good design are so shaped that they hold a sufficient amount of water to prevent excretions adhering to the surface of the bowl and that the flushing system thoroughly cleanses them. The open-front seat of wood or composition is the most sanitary. We find in old houses poorly designed closets with



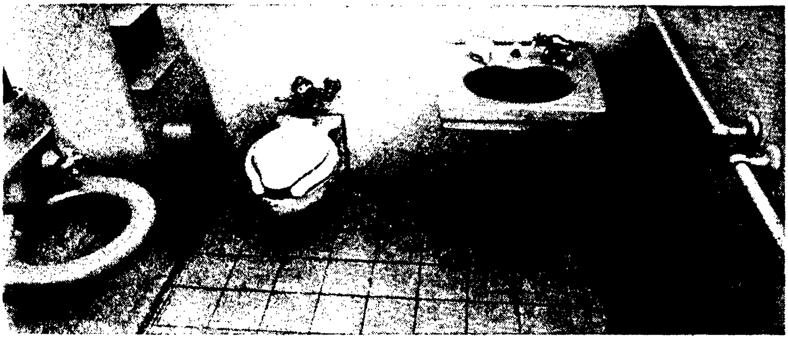
Gerard R. Colcord, Architect.

FIG. 62.—A sunny, colorful bathroom. Note the drawers beneath the lavatory, the medicine case, the colored tub.

inadequate flushing systems, but in most places the use of such closets is now forbidden.

A shower fixture may be installed satisfactorily over a tub in a recess if the walls are water-proof. A shower stall with a door is preferable. In this case there must be an opening at the top of the stall for the escape of steam and to provide ventilation.

Sinks are made with roll rims and deep aprons, with splash-backs and drain boards in one piece and with curved corners. These are sanitary and easily cleaned. Other sinks may be set in a frame of composition (Fig. 29) or of tile. When sink, apron, drain boards, and splash-back are of metal the metal should be sixteen gauge; when it is thinner than this it is very easily dented. The modern metal sinks are of alloys which are stainless and rust-proof. Besides the single sink there are double sinks one part of which may be used for washing dishes, the other for rinsing them (Fig. 27). Some sinks are equipped with a garbage receptacle in which the garbage may be thoroughly drained before it is disposed of. Sinks are made with built-in electric dish-washers (Figs. 24, 29). In large homes we sometimes find a vegetable sink deeper than the ordinary sink and divided into compartments for washing vegetables.



Richard J. Neutra, Architect.

FIG. 63.—Bathroom in a steel-built house. All fixtures including water-closet are wall hung for ease in cleaning. Walls and floors opaque glass, ceiling translucent glass. Indirect lighting.

Hot-water Supply System.—An important part of the plumbing of a house is the hot-water supply system. The water for the hot-water supply should be soft, otherwise the boiler and hot-water pipes have a scale deposited in them due to the fact that bicarbonates are less soluble in hot water than cold. Cold water is conducted through the boiler to a coil or water-back in the range or furnace or special hot-water heater. In this coil the water is heated and then it is stored in the boiler until wanted. The pipes which supply the boiler are so arranged that as water is drawn from it, fresh water enters it. The cold water should enter the tank at the bottom (Fig. 64), or if at the top through a pipe extending down into the boiler to prevent the cold water mixing with the hot water entering the boiler and reducing the temperature of the stored water. The pipe from the boiler into the range or other heater should be taken from the bottom of the boiler, otherwise water lower than the level from the tank will never be heated, and the water which has passed through the heating coils returned to the boiler above the level at which cold water enters the boiler. With this arrangement, there

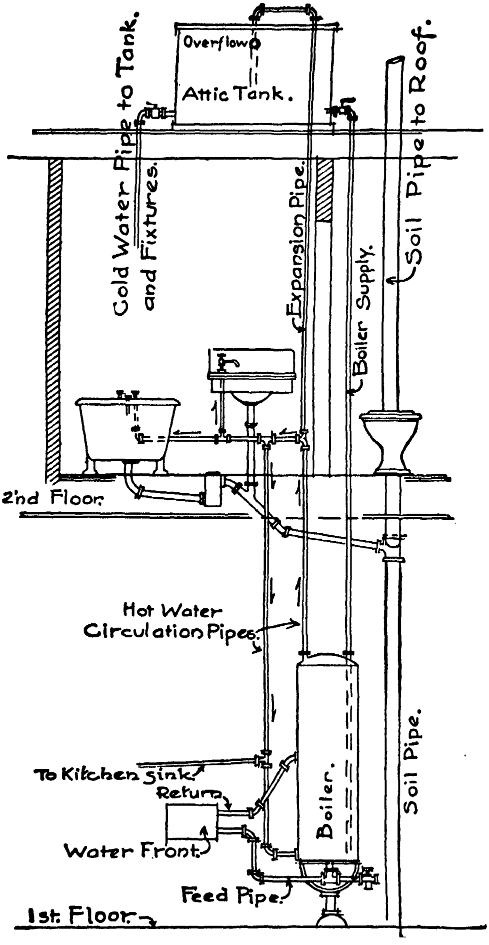


FIG. 64.—Diagram of hot-water system.

is always hot water at the top of the boiler and the water is constantly circulating through the boiler and heating coils, because hot water rises while the cooler water descends. The higher the return pipe is carried before it enters the tank the greater will be the velocity of the hot water through the whole system.

The Boiler.—The hot-water storage tank should be placed above the heater, and since it is unsightly and takes up room in the kitchen it is sometimes placed in a closet or suspended from the ceiling. The boiler has a cock at the bottom to drain off the water. Water should never be left in the heating coils when there is danger of its freezing. To drain them the supply must be shut off and then the boiler drained.

Distribution to Fixtures.—There should be a circulating pipe carrying hot water from the boiler through the house to all parts where it is to be used and returning to the boiler. Short runs of pipes tap this circulating pipe and carry hot water to the various outlets. This circulating pipe supplies hot water near each outlet, making it unnecessary to run off a large amount of cold water before hot water is reached, as one must do when each outlet is supplied directly from the boiler without a return pipe.

Water Heaters.—When gas is used as fuel for cooking the furnace is often used for heating water. The heating coils are placed in the firebox of the furnace instead of in the range. Even with coal or wood ranges containing coils, it is well to have coils in the furnace also, in order to secure a constant supply of hot water in cold weather. A boiler may be connected to two heaters, and when either one is not being used, water may be heated by the other.

Since the furnace and often the range are not in use all the year round special water heaters are made. The source of heat for these may be solid fuel, kerosene, gas, or electricity. When solid fuel or gas is used the heater must be connected with a flue. The boiler or tank may be insulated to prevent heat loss and save fuel. Gas and electrically operated heaters are provided with thermostatic control, to turn on the gas or electricity when the temperature of the water falls below that which the thermostat is set to maintain. The best gas heaters have safety devices which shut off the gas to the main burner if by any chance the pilot light is extinguished. Without this there is danger that for one reason or another the pilot light may go out and the gas accumulate in such quantity that it may asphyxiate one or a spark may cause an explosion. The small instantaneous gas heaters used in bathrooms should always be provided with a flue to carry off the products of combustion. These accumulating in a small bathroom are dangerous.

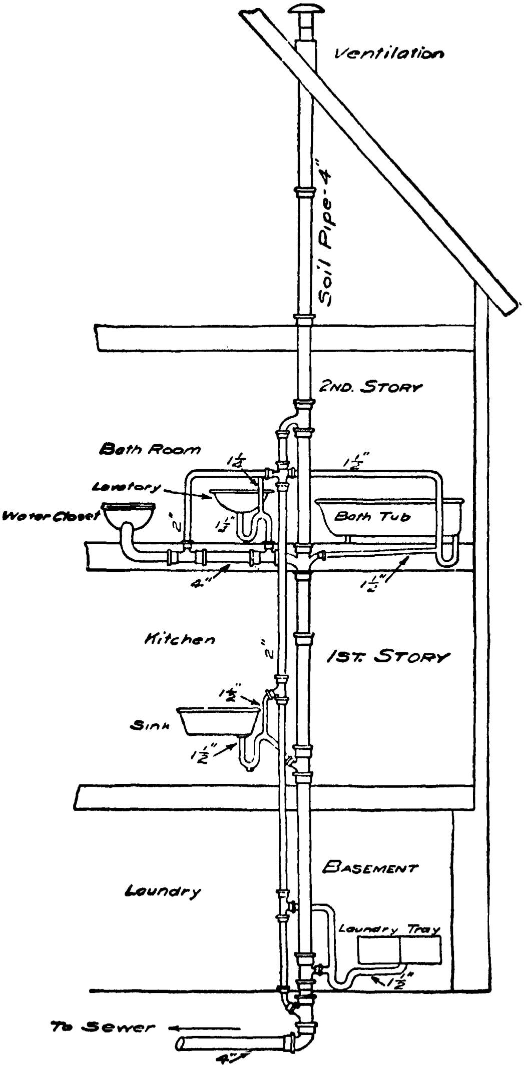


Fig. 65.—Diagram of waste system showing traps and vent pipes. U. S. D. A. Office of Exp. Stations.

Waste System.—The third essential of a plumbing system is a waste system. This must be impervious to liquids and gases and the waste pipes must be sufficient in size to carry off all waste, and yet small enough to be well flushed. The waste pipes are those which conduct waste water from the fixtures to the main waste pipe. The soil pipe is the pipe conducting waste matter from the water closet, and the waste pipes. The soil pipe should extend up through the roof and be capped by a ventilator. In the basement the soil pipe empties into the house drain which conducts the sewage out of the house to the house sewer (Fig. 65). The house should be so planned that the soil pipe does not extend through the roof near an attic window, for in this case bad odors might be carried into the house through the window.

Pipes.—The pipes for the supply system are of iron, steel, and brass. Brass is the best material since it does not rust but it is more expensive. Rust in the supply pipes is annoying because from time to time small particles are discharged with the water. After many years iron pipes may become so corroded as to leak. However, cast iron is most commonly and rightly used in the small house because as a rule the life of the latter is not long enough to warrant the use of the more expensive materials. Cast iron is used for the waste system. The best quality, that is, the heaviest, should be used because these pipes rust also. However, they are so large that it would be very expensive to use other material and, of course, rust in the waste system is not annoying as is rust in the supply system.

Traps.—Traps are bends in pipe or other devices intended to hold enough water—" the water seal "—to prevent air from the soil pipe making its way through the waste pipes into the house, and every fixture should have a trap. There is a great variety in the styles of traps used, some have a mechanical appliance to form a seal. There should be an opening into each trap in order that in case of obstruction it may be cleaned out. The simpler the trap the better. The value of the trap depends on its maintenance of the seal, its self-cleansing property and its accessibility. If a trap sounds hollow when it is struck with a piece of metal this is evidence that the trap is empty. A trap with seal unbroken gives a dull sound. There are several causes for the breaking of the seal. The water in the trap evaporates, hence it must be constantly renewed. When a house stands empty and the fixtures are unused, this is what happens. This evaporation may be prevented when closing a house by pouring oil into each fixture so that the water is protected from the air by a coating of oil. Another way in which the seal is frequently broken is by capillary attraction. If a hair or a piece or string gets caught in the trap with one end projecting into the pipe proper, enough water will pass along this thread to break the seal. Sometimes a sudden rush of water through the trap will, by its momentum, carry with it so much water that the seal is broken. To prevent this the seal needs to be deep, the trap straight and not less in diameter than the water pipe of the fixture. Air pressure on the seal from the direction of the sewer, back pressure it is called, often forces air through the seal, breaking it. The seal may fail by siphonage, in this case the water forming the seal rushes out of the trap when the sudden withdrawal of considerable air from the pipe below the seal creates a vacuum. This occurs whenever a large volume of water rushes through the waste or soil pipe creating a downward current of air.

Connection with Fixtures.—Fixtures must be near enough the main waste or soil pipe (which should be as nearly vertical as possible), to give them sufficient slope to discharge their contents rapidly. Another point to remember is that pipes should be kept away from the outer walls to prevent freezing. It is cheaper because it saves pipe to have plumbing fixtures one over the other; however, the cost of a second soil pipe, vent pipe and supply pipe are not enough to cause one to change otherwise satisfactory plans.

It is well to have all concealed connections accessible through a removable panel, located in a closet when possible, to avoid tearing out part of a wall if there is trouble.

Plumbing Ordinances.—Ordinances governing plumbing sometimes impose unnecessary requirements and make the work expensive. Most of these were passed in good faith as health measures, but after it has been shown that the supposed connection with health was a mistaken idea, it is difficult to get such ordinances repealed for fewer plumbers and plumbing supplies would be needed in the community. The Bureau of Standards of the U. S. Department of Commerce has attempted to standardize plumbing requirements. It pays to have a plumber who thoroughly understands his business and who has a reputation for doing good work, for there are many defects commonly found in plumbing and poor plumbing is always an annoyance and expensive.

Sewage Disposal.—No simple satisfactory system of sewage disposal for the isolated house has as yet been devised. One way in which sewage is gotten rid of is to allow it to flow into a running stream. If the flow of water in the stream is sufficient to carry the sewage away rapidly enough, this method may be satisfactory to the occupants of the house from which the sewage comes. However, this way of disposing of household waste pollutes the stream and makes it a source of danger. While it is true that running water purifies itself, disease germs have been found in a stream many miles from the point where the water was contaminated. In many districts it is unlawful to dispose of sewage in this manner, and in all places the manner of disposal should be regulated.

Cesspools.—Cesspools are often provided to receive sewage. There are two types of cesspool, the tight, and the leaching. The tight cesspool, as its name implies, is water-tight with a pipe to carry off the liquid. This is emptied into a stream or a ditch, is used for irrigating sometimes, or is distributed by tile under the surface. This liquid is, however, foul, offensive and a source of danger. The solid matter in the cesspool must be removed periodically. The leaching cesspool is built up loosely of stone or brick, and this construction permits the liquid to leach out into the surrounding soil. This, of course, gradually increases the pollution of the soil until sources of water supply in the neighborhood may be contaminated. With either type of cesspool there is the problem of the disinfection and disposal of the solid matter.

Septic Tank.—The next step in advance in this matter is the septic tank. In this system the sewage is collected in a covered tank which is usually designed to hold the waste material for eight to twenty-four hours. In the longer time ten per cent. more organic matter is removed. Here it is acted upon by bacteria which convert a large part of the solid material into liquid. These bacteria are anaërobic, that is, they do not require air, in fact must be protected from air. In the tank they are protected by a thick scum which forms on the surface of the sewage and until this scum is formed or at any time when it is disturbed or broken up the bacteria cannot do their work. This bacterial action effects a partial purification. The best-designed septic tanks have two compartments (Fig. 66). Into the first, the sewage from the house sewer is emptied through a pipe which dips at least one foot below the surface of the liquid in the tank. This is to prevent the disturbance of the scum on top which protects the bacteria from air. The tank should be deep enough to allow the sludge to settle to the bottom, there to be liquefied. The outlet from this settling chamber into the second chamber, like the entrance, should be below the surface of the liquid of the settling chamber or protected by a shield before it, in order to prevent the breaking up of the scum and its entrance into the second chamber. From the second chamber the liquid, which is nearly colorless and odorless, but which is not purified, is usually distributed over the surface or a little under the surface of the ground where bacteria, air and light may complete its purification. Because the discharge over the surface or subsurface should not be continuous but should occur at intervals in order to allow air to penetrate into the soil between times, this second chamber of the septic tank is provided with a siphon which periodically empties it. This siphon works automatically, when sufficient water has collected in the discharge chamber. This should be every eight or twelve hours, depending upon the character of the soil over which the discharge is distrib-

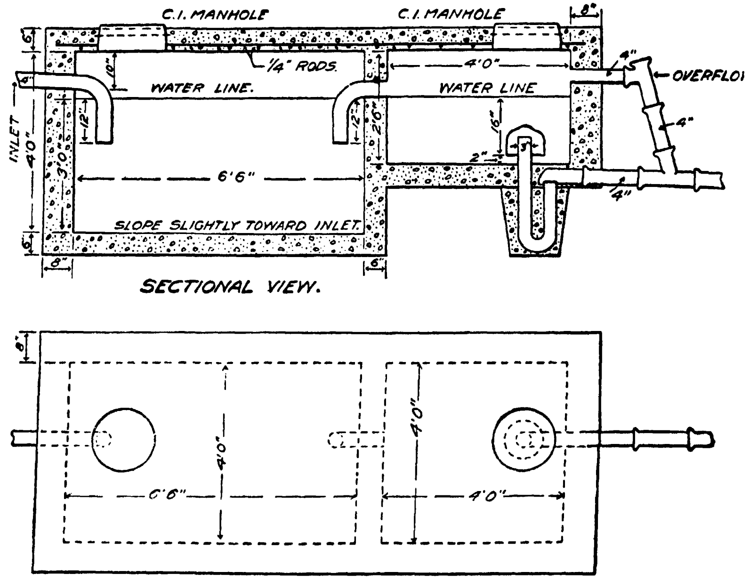


FIG. 66.—Diagram of septic tank. U. S. D. A. Office of Exp. Stations.

uted. The first chamber of the septic tank should be large enough to hold all the sewage discharged into it in eight hours, at a depth of five feet if possible. It should also be large enough to be entered for cleaning. The second chamber should be of a size to allow the discharge of its contents at the desired intervals.

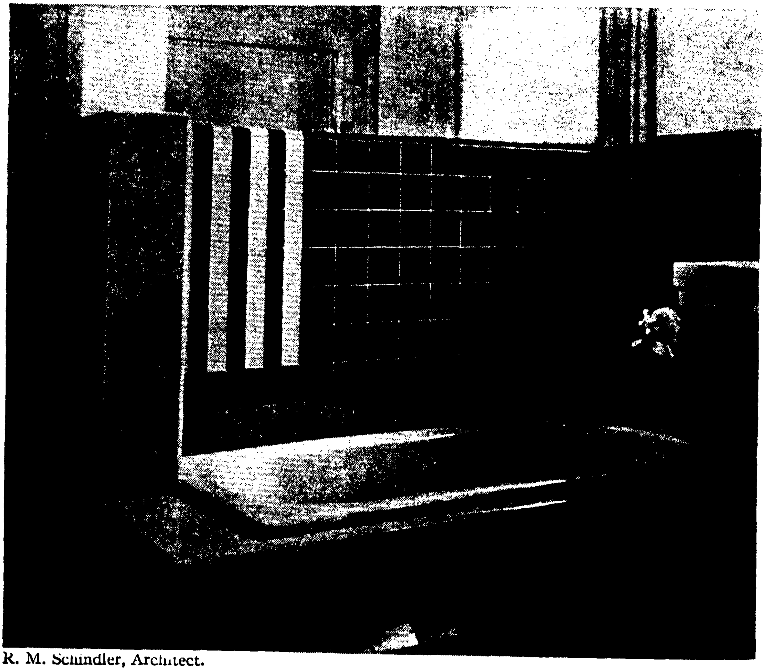
Different types of septic tanks are required for different conditions. The slope of the ground from the house to the tank, and from the tank to the place of final disposal, and the character of the soil are the most important factors which should govern the design of the tank. While a properly designed system of sewage disposal is expensive, one which is inadequate for the situation can be only a source of trouble. Although numerous pamphlets giving directions for the construction of septic tanks are published by cement companies, the United States Department of Agriculture, and the State Universities, it is best to have a system designed by a competent person, for many situations require a specially planned system.

Disposal of Material from Septic Tank.—Final disposal may be effected in three ways, by running the waste into a stream, by distributing it over the surface of the ground or by subsurface distribution.

The liquid from the septic tank may be run through a pipe or a ditch to a stream, but since it carries many impurities, this method is not safe if water from the stream is used for household purposes by any other family. If the stream becomes low the sewage stagnating in it will undergo putrefaction and develop bad odors.

The sewage may be distributed over the surface of the ground, there to be acted on by air, sunlight, and bacteria. About five hundred square feet of disposal area are necessary for each person, if the soil is porous, much more is required in dense soils. Any land used for this purpose should be several hundred feet away from any source of water supply. The sewage is conducted to this plot by pipe and discharged through distribution tile or distribution ditches. These are arranged from four to six feet apart to have grade enough to spread the sewage evenly and quickly over a large area. The discharge into the disposal field must be intermittent to allow air to penetrate into the ground between floodings, for the bacteria which complete the purification of the sewage are aërobic. Crops if not eaten raw may be grown on this land, but dairy cows should not graze upon it.

A way of final disposal more frequently employed is the subsurface disposal scheme. This means the discharging of the liquid from the tank into a system of open-jointed drain tile, through which the fluid leaches into the soil. The drainage tile is laid eight to twelve inches below the surface, with joints one-fourth inch apart and covered with flat stones or broken tile to prevent loose earth from falling back into the pipe. The grade should not be greater than three inches per one hundred feet. With this way of disposal, as with the former, an intermittent discharge is essential in order to allow aëration. The subsurface drainage tiles must not be at a greater depth than twelve inches because air will not readily penetrate to greater depth, consequently the aërobic bacteria which



R. M. Schindler, Architect.

Fig. 67.—View of bathroom lighted by high windows.

nitrify the impurities cannot be counted on at a depth greater than this. The disposal field should be two hundred feet from the house. In a loose, porous or sandy soil about thirty feet of drain tile should be allowed for each person, twice as much in a heavy soil. Subsurface disposal is not well adapted to heavy, firm soils. When the soil is dense, trenches are dug and filled to a depth of twelve to sixteen inches with gravel or cinders, the tile laid in this with twelve inches of soil on top. If there is no subsurface drainage an additional line of tile in the bottom of the trench is necessary and the trench should be deeper.

In swampy soil neither of these methods is applicable and a sand filter must be constructed. This consists of a bed of sand, fine on top and gradually changing to coarse gravel toward the bottom. It should be four or five feet deep, provide fifty square feet for each person and be so arranged that one-fourth to one-third of it only is used at a time, in order that the rest of the area may dry and air. The sewage is distributed over the surface by open-jointed tile as in ordinary disposal. There should be sufficient underdrainage to allow each flood of sewage to disappear rapidly.

Sludge, that part of the solid matter which is not liquefied or gasified in the tank, must be removed from time to time and burned or disinfected and buried.

PROBLEMS

1. What is the source of the water which you are using at home? Elsewhere? Are there any sources of danger in these supplies? What guaranteee have you as to their safety?
2. What measure can (1) a small community, (2) a city, take to insure for itself a good water supply?
3. What advice would you give to a camping party as to use of water?
4. Locate the stop-cock for shutting off the water in the house where you live.
5. Study the hot-water system in the house where you live. Could it be improved?
6. If you lost a diamond down the wash basin and no plumber were available what would you do to recover it?
7. Look up advertisements of farm water supply systems, and of sewage disposal systems. Write for literature and study it.

*8. From a plumber's catalogue select the fixtures you wish for your house, locate the waste and soil pipes on your house plans.

*9. With transparent paper over your house plans, plan the hot-water system.

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* The starred problems are those of a connected set running through the book.

CHAPTER VII

HEATING

Besides heating by stoves and fireplaces there are three heating systems commonly used for dwellings: (1) Warm or hot air, (2) hot water, and (3) steam.

Direct and Indirect Systems.—In the first or hot-air system the air is heated at the furnace and carried to the various apartments. This is called indirect heating. When the radiators, steam or hot water, of the other two methods are in the rooms to be heated, these systems are called "direct." When the radiators are in the basement and there heat the air which is carried to the apartments to be warmed, these systems are called "indirect."

Heating and Ventilation.—Direct systems warming the air which is in a room do not provide for ventilation as the indirect systems do. The indirect systems forcing warm air into a room force out of it an equal measure of used air, and this is a great advantage. The air which is heated in the basement in the furnace drum, or by steam, or hot-water radiators, may be taken fresh from the outside through a cold-air duct or it may be "recirculated" air, that is, air forced out of the different parts of the house by the warm air and then conducted to the basement to be heated and returned to the various rooms of the house. Even this latter method provides better air than do the direct heating systems which heat the air in the individual rooms. Of course, there is always an exchange of air going on between that outside the house and that inside. The outside air comes in through cracks and crevices, the opening of doors, and even through the walls, and replaces an equal amount of air from the house. The greater the difference in temperature between the outside and the inside air, the more rapidly does this exchange take place; at usual temperatures it is not sufficient, however, to keep the air fresh in a small room where there are two or more people. In properly heated and ventilated halls, theatres and churches in which large numbers of persons gather, indirect systems with pumps and fans are provided to force in fresh air, and to drive out the used air which is full of impurities thrown off from the bodies of the occupants. But in dwellings, fans are not often used, gravity being depended upon to keep up the circulation of air, since hot air rises and cold air falls. Stoves are direct heating systems and besides not providing for ventilation they use up the oxygen of the air and give off some of the poisonous products of combustion. A fireplace, the flue of which is never closed, insures good ventilation even when there is no fire in it, because so much warm air goes up the chimney that a strong draft is created which draws fresh air into the room.

Basis for Design of Heating Plant.—A heating system should be carefully planned for any building, although for small dwellings we usually buy a furnace of the size the dealer assures us he knows by experience will keep the house warm. The steam boiler, hot-water heater, or warm-air furnace must be large enough to adequately heat the house on the coldest days. Heating systems are designed on the British thermal unit basis. The B. t. u., as it is called, is the amount of heat required to raise the temperature of a pound of water one degree Fahrenheit. The B. t. u.'s lost by conduction and radiation through the walls of a building and those lost with the air which leaks through cracks, must be replaced by B. t. u.'s from the heating system. We have formulæ for calculating heat loss from various surfaces at different temperatures and for the leakage from any given room. The loss of heat increases as the outside temperature falls, therefore a heating system must be equal to making up the heat lost on the coldest days. Many indirect systems are so designed as to be adequate when using outside air, to replace the heat lost when the temperature is the average winter temperature. When the weather is colder than this the house may be kept comfortably warm by shutting off the outside air and using recirculated air in its place; this is much warmer than the outside air and can be heated to the desired temperature more quickly and with less expenditure of fuel.

The Furnace Flue.—No matter what system is used there must be a well-constructed furnace or smoke flue of the proper size and located in the proper place. A twelve-inch by twelve-inch flue is large enough for a six- to ten-room house. It must go up as nearly straight as possible, any turns which it makes should be gradual, for a sharp angle reduces the efficiency very much. The flue must be insulated to minimize the danger from fire and it should be carried two feet beyond the highest point of the roof in order to insure a good draft. Sometimes a well-constructed flue does not draw because of tall buildings nearby, or trees which interfere with the draft. The remedy is to carry the flue up higher, or to trim the trees. The furnace flue should be near the centre of the house in order that the pipe from the furnace to the flue may be short. To protect it from rust due to rains coming down the flue, it is advisable, with any system, at the end of the heating season to take down the pipe from the furnace to the flue or to disconnect it from the flue.

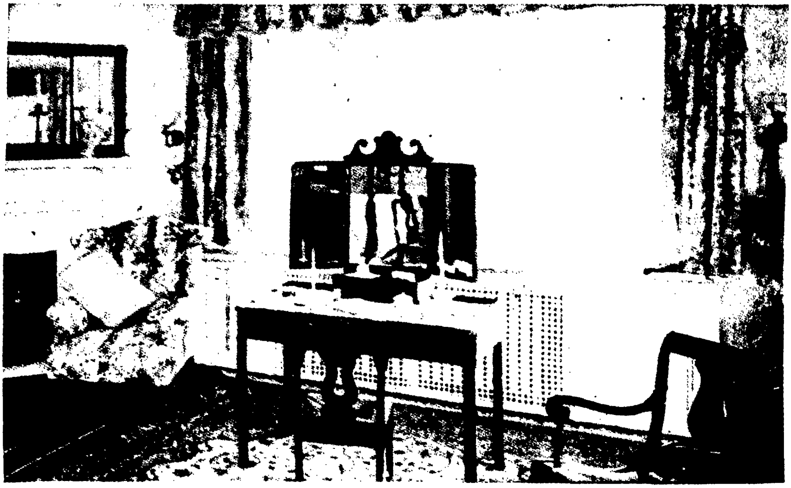


Fig. 68.—A radiator concealed beneath a window.

Fuels.—Wood, coal, oil and gas are all used as fuel, of course with specially designed furnaces. Wood is perhaps the choicest fuel to use. It is clean, and if there is any odor from it, it is a pleasant one, while from other fuels we often have disagreeable odors. Gas is the most convenient fuel, the furnace needs no looking after, once the gas is lighted. Coal, most commonly used, has nothing to recommend it except that in most places it is the cheapest fuel and a coal fire requires replenishing less frequently than a wood fire, but coal is dirty and its use requires the most work in removing ashes and keeping the house clean.

Radiators and Registers.—A direct steam heating system, or hot-water system, necessitates radiators in the rooms, these are not beautiful and they take up space. They may be concealed behind grills or under window seats, but in this case (Fig. 68) must be from ten to twenty-five per cent. larger than if they were uncovered. The increased radiation is necessary because the cover interferes with the circulation of air, and the amount of increase required depends upon the design of the grill. There should always be a large open area at the floor, otherwise the cold air from the floor will not be drawn over the radiator (Fig. 69). The hot-water system in which circulates water at a temperature of one hundred to one hundred and eighty degrees must have larger radiators than a steam system in which the steam is at a temperature of at least two hundred and twelve degrees, and besides in condensation gives up the heat of vaporization. Warm air registers are not so unsightly and they occupy less space. Heated air should enter the room at a temperature of one hundred to one hundred and fifty degrees, not higher as is usually the case. There must be a larger volume of air at this temperature than at the temperature at which most furnaces supply it. This means larger ducts and registers than we commonly find. Most furnaces are in reality hot- rather than warm-air heating systems. It is more expensive to install and to operate a furnace which supplies warm air, and

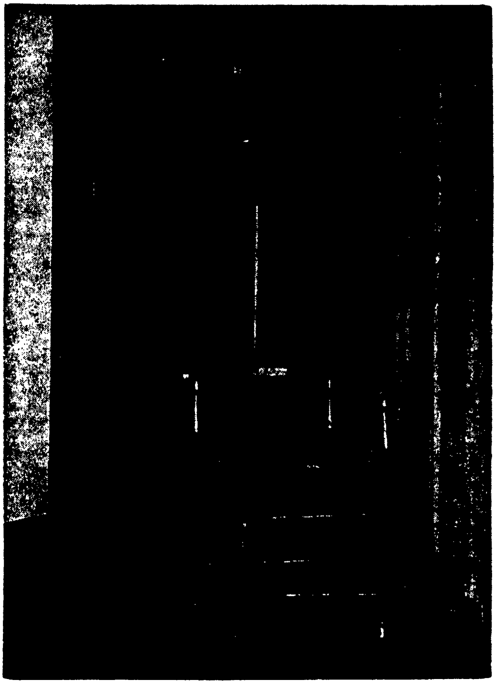


FIG. 69.—A radiator hidden behind a grill in a niche—note the opening at the bottom.

since people do not realize that hot air is detrimental to health the smaller and cheaper furnace is usually installed.

Panel Heating.—This comprises a system of warm-water coils concealed in walls, floor, or ceiling through which heat is dispersed almost entirely by radiation. Close contact between the coils and the heat-radiating surface is necessary. Wood and similar porous materials do not make good heating panels while concrete and plaster in which the coils are imbedded are most satisfactory. Other means of supplying heat to the radiating surfaces may be employed. With panel heating there are no registers or radiators. Persons warmed by radiant heat are comfortable at an air temperature several degrees below that necessary when they are warmed by heat conveyed by warm currents of air.

Basement Space.—Steam and hot water systems occupy less basement space than the warm-air system because of the large drum for heating air which surrounds the furnace proper and the warm-air ducts which are essential parts of the latter system. The warm-air ducts must slope up from the drum in order that the heated air may rise, and they should have as few changes in direction as is possible in order to facilitate the passage of the warm air. For these reasons the warm-air furnace is placed near the center of the house, sometimes in a pit, and the warm-air ducts enter the rooms of the house from inside walls. It makes little difference where steam and hot-water furnaces and radiators are located. The furnace may be on the ground floor instead of in the basement and radiators are commonly set under windows.

Flexibility.—A warm-air furnace will heat a house more quickly than either a steam or a hot-water system and when the fire goes down the house will cool more quickly, because it takes less time to warm air than it does to heat water or make steam, and because hot water and steam give off the heat slowly. A warm-air furnace on chilly days in spring and fall may be fired for a short time morning and evening, to take off the chill, but it takes several hours to get up steam or to warm rooms with the hot-water system. Warm-air and hot-water systems may be used on a cool day to give just a little heat, for the air and water may be warmed just sufficiently to take the chill off, but steam must always be steam, that is, water heated to at least two hundred and twelve degrees. Once the water is warmed in the hot-water system a little heat may be continuously furnished for as long as one wishes.

Care and Availability.—Hot-water pipes and steam pipes sometimes leak and do considerable damage. If the house is left empty during the winter season the water must be drawn from either system to prevent freezing, and at the end of the cold weather the pipes should be emptied. The warm-air furnace needs no such attentions and when a cool day comes in July it is in order unless the pipe leading to the flue is down and even if this is the case, the pipe may be put up in a very short time.

Relative Costs.—When we consider the cost of these three systems we find that hot water is a more expensive system to install than steam, and that the cheapest is the warm-air system. When properly installed this costs only a trifle less than steam, but the unhealthful hot-air systems are considerably cheaper. When it comes to cost of operation we find this order to be exactly reversed, warm- or hot-air systems are most expensive to operate, next steam and then hot water. The care required in management is least for the hot-water and greatest for the steam system because of the large number of appliances needed for safety with the steam system.

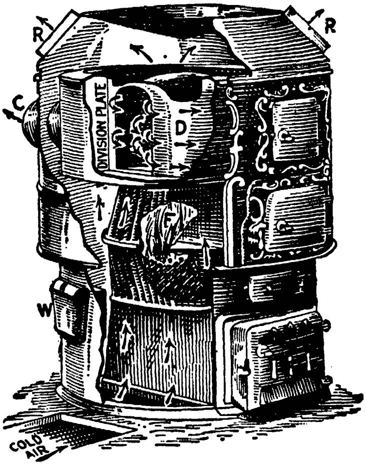
Quality of Air.—We should remember that direct heating systems do not provide proper ventilation, and that an indirect system using outside air is the best. Sometimes we find openings fitted with shutters in the outer wall behind radiators which may be opened to supply fresh air which will be warmed in passing over the radiator. If the wind is very strong these may be partly or entirely closed. More or less dust is admitted through these openings. Air taken into the house to be heated should be pure and the duct through which it enters should be provided with a screen. There are devices for freeing the air from dust, and for moistening it to keep it from being too dry. Hanging long, narrow tins behind the radiators and keeping these constantly filled with water will put some moisture into the air of a room, but not sufficient to give as much moisture as in desirable for the sake of health. A boiling teakettle some place in the house, and plants also help to keep air moist. With the very dry air which we find in most heated houses, water evaporates so rapidly from the skin that it makes us feel cold. A little moisture added to such dry air makes us comfortable at a lower temperature than we should find comfortable without the moisture. Very dry air, because of its drying action, is also injurious to the nasal passages, sometimes causing catarrh. Radiators and registers ought to be kept always free from dust.

Temperature Standard.—As air is heated its relative humidity is lowered; that is, its capacity for absorbing moisture is increased. Most houses have little or no provision for humidifying the air and because of this, it is not only too dry but overheated as well. Sanitarians recommend that the temperature of a heated house should be kept below 70° F. Below this point the humidity in most cases is not too low for comfort and health.

Warm Air Heating.—The warm-air furnace, or rather the hot-air furnace, is the one most often used in small houses. It consists of a firebox and drum in which the flames circulate, and around this firebox is a chamber where air is heated. Air is a poor conductor of heat and because it takes some time to heat it, this chamber should be large and likewise the drum in which the flames circulate. The outer wall of this chamber is of non-combustible material. In this air-heating division of the furnace should be a water box which may be filled from the outside. The water evaporating moistens the air, and so makes it less injurious. The grate surface should be large enough to produce sufficient heat with a moderate fire. There is always loss of heat when a hot fire is kept up, because the large amount of air required for combustion makes a strong draft which carries the flames, gases, and heat rapidly up the chimney (Fig. 70). In order to heat a house economically and healthfully, that is, to avoid sending hot air, rather than warm air, into the house the furnace must be large and the warm-air pipes distributing the air must be large, considerably larger than the hot-air furnaces and ducts we usually find. The fresh-air duct should open into a spot above the ground level where good, clean air is found and the opening should be screened to keep out animals and rubbish. The duct must be arranged so that it may be easily cleaned.

Location of Furnace.—With the warm-air furnace the matter of location is of importance. Wind blowing from a certain direction, makes it difficult to heat that side of the house, for there is a back draft down the warm-air flues. On this account the pipes to the side of the house in the direction of the prevailing winter winds should be as direct as possible and a trifle larger than would otherwise be required; this means that the furnace should be located near the centre on the cold side of the house.

Warm-air Ducts.—The warm-air pipes must have an upward slant, for warm air rises, and a level pipe retards the ascent. The pipes to the second floor, because of their rise, like chimneys, have considerable draft, therefore the ducts leading to the upper floors may have a longer nearly horizontal run than those to the first floor, where there is little rise to create a draft. Bends and turns in a warm-air duct check the flow of the air. It is almost impossible to heat a room with such a duct. Sometimes by closing every other pipe at the furnace warm air may be forced into such a room. In large houses heated by warm-air furnaces it is necessary sometimes to use two or more furnaces in order to reach each room by a warm-air pipe without too many turns, or sometimes in large houses a combination of warm air, and hot water or steam is used. The warm-air ducts ought to be well wrapped with insulating material to prevent heat loss and to avoid danger of fire. The shut-off in each pipe at the furnace also saves heat when it is desirable to shut it off from certain rooms.



From *Mechanics of the Household* by E. S. Keene McGraw-Hill.

FIG. 70.—Interior view of a warm-air furnace.

Location of Registers.—We usually find the registers in that part of the room nearest the furnace. This saves piping and usually is necessary to avoid horizontal runs of the warm-air ducts, but evidently the room cannot be so evenly heated as it would be if the register were near the outer wall.

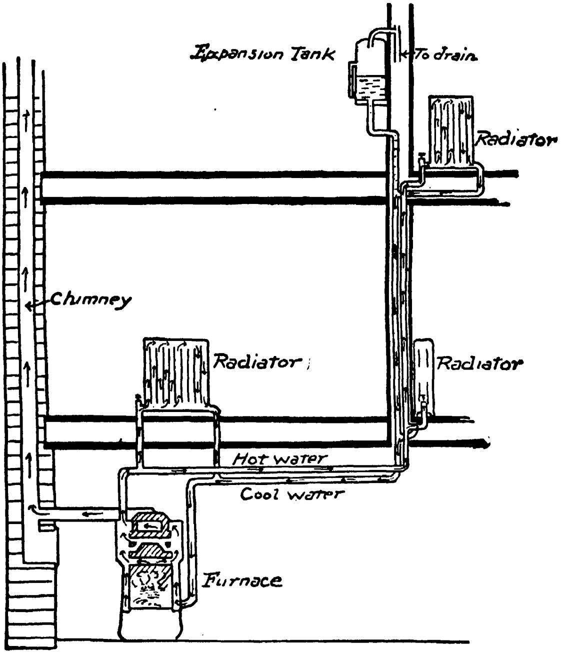
Shut-off Room.—Sometimes with the indirect system it is difficult to heat a room which has been shut off for a time. The register and shut-off at the furnace are opened but the warm air does not enter the room. This is because of the cold air in the room, air at about the same temperature as that outside. If a door connecting the room with the rest of the house or a window is opened so that the cold air of the room may more easily be driven out by the entering warm air the room will be warmed quickly.

Pipeless Furnace.—The pipeless warm-air furnace is easy to install, but it is better adapted to small one-story houses and to churches and other auditoriums on one floor than to large or to two-story dwelling houses. In a home heated by one of these furnaces the heat is not evenly distributed and the open doors and the registers opening from room to room permit the passage of sound as well as of air, destroying the privacy of the rooms.

Hot-water Heating.—A hot-water heating system consists of the heater, the expansion tank, the distributing pipes and the radiators. The heater is usually a boiler with the firebox built inside. The water comes directly in contact with the outside of the firebox and with a number of pipes through which the flames and gases pass on their way to the smoke stack. The water is constantly circulating in the hot-water system. It takes some time to heat all this water and consequently to warm the house, also the reverse is true, it requires some time to dissipate the heat, hence the hot-water heating continues to operate after the fire has died down.

Expansion Tank.—The water-heating chamber must be connected with a tank to allow for the expansion of the water when it is heated. This expansion tank must be provided with an overflow pipe to carry off water in case of an oversupply, due to overheating. This may be connected with the sewer or it may be arranged to empty into the bath tub or some convenient place in the basement (Fig. 71). There is but one pipe to the expansion tank, therefore there is no circulation and the water in it remains cold; for this reason it must be placed where there is no danger of freezing.

Piping.—From the top of the water-heating chamber a supply pipe goes to the radiators. The supply pipe must be of a size adequate to supply all the radiators and it must lead to them as directly as possible with as few turns as possible in order to secure the best circulation. At each radiator a branch pipe from the supply pipe conducts the hot water to the radiator, and from each radiator other pipes return the water which has lost much of its heat to a return pipe which goes back to the boiler. In the overhead system, the supply pipe goes first to the upper story and from this pipe, on its return to the basement, supply pipes lead to the tops of the radiators and the return pipes from the radiators also branch into this main circulation pipe.



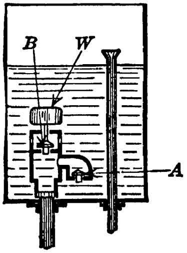
From Lynde's *Physics of the Household* used by permission of The Macmillan Company.

FIG. 71.—A hot-water heating plant.

Hot Water Under Pressure.—A variation of the system of hot-water heating has a closed expansion tank. This results in the generation of pressure and so in raising the temperature of the water of the system. With this form of hot-water system less radiating surface is needed than with the open expansion tank. A closed expansion tank must have a safety valve, otherwise if the water becomes overheated the tank may burst.

Combination Closed and Open Tank.—A combination of these two varieties of hot-water heating systems may be had by the use of valves at the end of the pipe leading to the expansion tank. When the valve admitting water to the expansion tank is closed the water in the pipes if heated sufficiently will be under pressure, when the valve connecting the pipes with the tank is open there is no pressure. This valve is so designed that water does not flow into the expansion tank until the pressure has reached, say ten pounds, then when the pressure falls to zero by cooling of the water in the system, another valve opens to allow water from the expansion tank to flow back into the system to fill it (Fig. 72).

Air Vents.—Air collecting in a radiator diminishes the radiation. In some cases enough air may collect to stop the circulation in a radiator. Because of this accumulation of air each radiator should have an air vent at the top. This may be opened to allow the escape of air. The overhead system requires no air vents for air entering this system finds its way to the expansion tank.

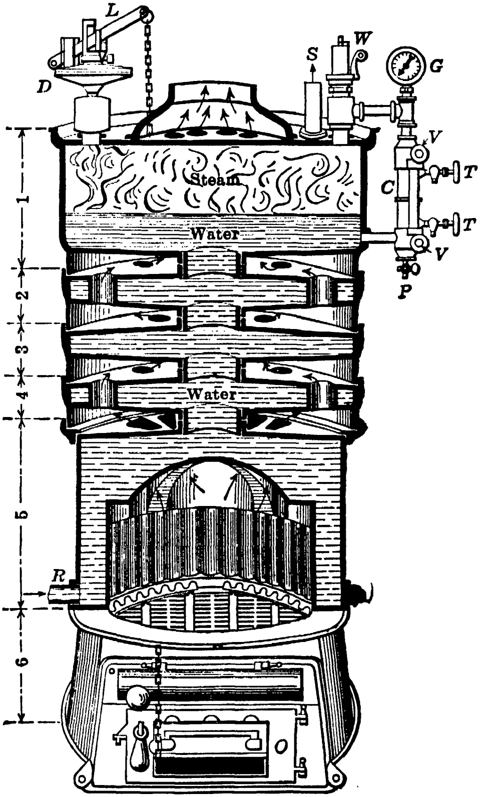


From *Mechanics of the Household* by E. S. Keene, McGraw-Hill.

FIG. 72.—Expansion tank with valves which make of it either an open or a closed tank. B opens when pressure in system reachesa certain point. When pressure falls, A opens, allowing water from tank to enter the pipes.

Steam Heating.—A system of steam heating is better adapted to a large building than to a small house. The low-pressure gravity steam system and the vapor-heating system are the ones employed in buildings of moderate size, the vacuum system in larger buildings. Steam holds large amounts of heat, for water changing into vapor absorbs large amounts of heat without its temperature being raised. On changing back to water the vapor gives up this heat—the latent heat of vaporization as it is called. It is chiefly this heat of vaporization which warms our rooms. The furnace for steam heating has the water for generating steam in pipes or chambers in close conjunction with the firebox. There are different styles, a cylindrical furnace being commonly used in residences. Attached to the boiler at the water line is the water column and gauge-glass which show the water level in the boiler, which should be kept within certain limits. The steam gauge also attached to the water column indicates the steam pressure (Fig. 73). Every steam boiler must have a safety valve to guard against excessive pressure. For houses this safety valve is usually arranged to blow off at about ten pounds, the system being operated under three or four pounds pressure.

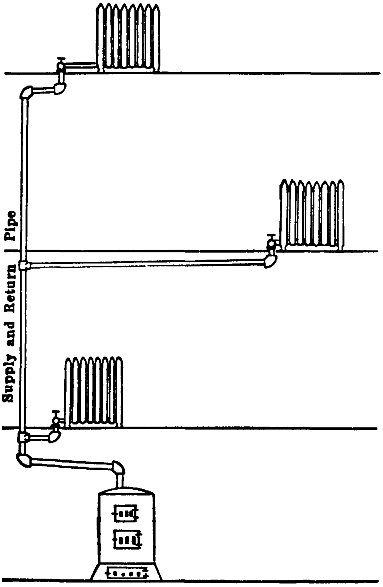
Low-pressure Gravity System.—In the low-pressure gravity systems there are two ways of arranging the pipes which carry steam to the radiators and return the water of condensation to the boiler, the single-pipe system and the two-pipe system. In the first system a single pipe for supply and return connects the boiler and the radiators. Steam from this pipe enters the radiators, is condensed and then the water of condensation flows back to the boiler through the same pipe. The water is of much smaller volume than the steam and affords little opposition to the flow of the steam if the pipes are so arranged that no water is retained in them. Poor circulation and a hammering in the pipes is the result of an accumulation of water. There is a valve where the steam pipe connects with the radiator, when this is opened to admit steam the air vent must be opened to allow the escape of air, otherwise the steam will not enter. Most radiators are supplied with automatic air vents. If the valve is only partly open steam will enter and condense, but the water will not always return through a small opening which will admit steam. This condition is the cause of considerable noise. To avoid trouble it is necessary with the single-pipe system to have the valves admitting steam to the radiators always wide open (Fig. 74).



From *Mechanics of the Household* by E. S. Keene, McGraw-Hill.

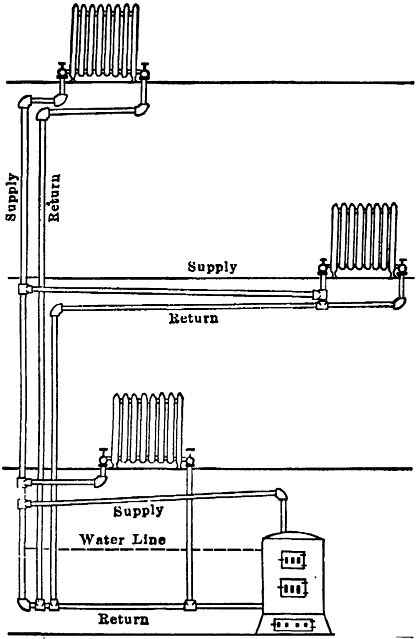
Fig. 73.—A steam-heating furnace—water column and gauge-glass, C, steam gauge, G.

Two-pipe System.—Where distances from boiler to radiators are much greater than in an ordinary residence, the two-pipe system is required in order to secure satisfaction. In this system one pipe carries steam to the radiators and a second one conducts water away from them. Each radiator has a branch supply pipe and a branch return pipe to the main pipes. There is a connection at the bottom of the main supply pipe to the return pipe for water which has been condensed in the supply pipes. When such a steam system as this is in operation with one or more radiators shut off, we often have trouble when one of these radiators is opened. This is due to the fact that the return pipe sometimes contains steam, that is, all the steam does not condense in the radiators which have been open and so passes into the return pipe. When



From *Mechanics of the Household* by Keene, McGraw-Hill.

FIG. 74.—Diagram of a single-pipe steam-heating system.



Keene's *Mechanics of the Household*, McGraw-Hill.

FIG. 75.—Diagram of a two-pipe steam-heating system with the return pipe from each radiator connecting with the main return pipe below the water line in the boiler.

this is the case and another radiator is opened we have steam entering it from both the supply pipe and the return pipe and sometimes the water cannot escape readily and we have a pounding in the radiator. In order to avoid this there must be a separate return pipe from each radiator to the boiler or to a main return pipe making the connection with this return pipe below the water line in the boiler (Fig. 75).

Vapor Heating.—The vapor-heating system differs from steam heating in that it is operated at a pressure of a few ounces rather than pounds. Many manufacturers put out systems of vapor heating under trade names. These systems have been generally satisfactory.

The Thermostat.—The thermostat is a device for automatically regulating the temperature. The thermostat regulates the temperature by operating the furnace dampers. There are many different kinds of thermostats, but most of these in use in residences are electric and regulate the drafts by means of a motor. Thermostats may be set to maintain a constant temperature at any degree, or they may be arranged to allow a low temperature for some time and then at any desired hour to raise the temperature.

Cooling Systems.—Cooling systems may be had for houses as well as for theaters, hospitals, and office buildings where they are more commonly found. It costs much more to lower the air temperature a given number of degrees than to raise it an equal number. As these systems become cheaper they will be more widely used.

PROBLEMS

1. Would climate influence your choice of heating system? How? Why?
*2. Trace the floor plans of your house and on the tracings work out a heating system. On basement plan show furnace, fresh-air duct, smoke pipe to chimney and the warm-air ducts if a warm-air furnace is your choice. Show radiators or registers in each room.
3. Keep a record night, noon, and morning of the temperature at your home or at school during a week of winter weather.

* The starred problems are those of a connected set running through the book.

CHAPTER VIII

LIGHTING

Poor lighting affects health and comfort unfavorably, producing eyestrain and headaches. Good lighting not only prevents eyestrain, but it adds to the beauty of our surroundings; thus the arrangements of the sources of artificial light including the choice of fixtures are important considerations.

Necessity for Light.—We require light to see our way about, to work by, for decorative effect, or often we desire all of these at once. Light to work by necessitates more light than that which we need to make a "pathway safe and plain." More light is needed for fine work on dark objects than for reading or writing. A shaded light directly over head does very well for lighting a dining-room table, but for displaying pictures it is most unsatisfactory. In order to get thoroughly satisfactory results we need to study carefully this matter of lighting.

Amount of Light Required.—One of the laws of physics is that the amount of light at any point varies inversely as the square of the distance from the source. This law cannot be applied to interiors because of the large and varying amounts of reflection by the walls and furniture (Fig. 76). Dark surfaces absorb much more light than light ones, the former may absorb ninety per cent. of the light, white and pale yellow about half as much.

Effects of General and Local Lighting.—Usually we wish a general illumination in any room with perhaps local light for fine work. Local lighting alone has the effect of shutting off the unlighted areas and so gives a sense of privacy and coziness, but a local light without general illumination is likely to cause a strain on the eyes unless the gaze is confined to the lighted area (Fig. 77). For example, the switching on of a strong electric light in the daytime does not try the eyes, but at night, when the pupil is enlarged to admit all possible light, and this happens, the effect is painful; the pupil does not adjust itself in time to shut out the intense light. So in turning the eyes from dark areas to lighted ones we get the same result, only in a less degree. Again, the constant adjusting of the pupil to changing amounts of light will tire the eye. Strong local lighting with just enough general illumination for one to find one's way about comfortably, gives almost the same effect of privacy as local lighting alone. We often see this lighting arrangement in restaurants where each table has an individual light. At a large dinner party, or other gathering, individual lights would be an annoyance, so on such occasions it is best to have a brilliant general illumination.

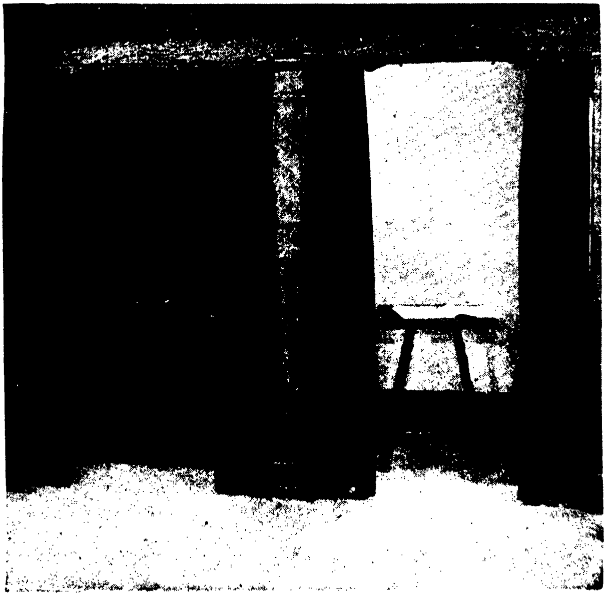


FIG. 76.—Picture of the same room and the same lights: (a) With walls in black (b) with walls in white.

Lights Used to Modify Appearance of Room.—Lights may be so arranged as to change the apparent shape of a room, by having the lighting non-uniform, or some particular feature may be emphasized or hidden to a degree by the same device.

Direction from Which Light Should Come.—In order to get the right effect the source of the light should be as little in evidence as possible (Fig. 78). We do not care for the light in the lamp, only the light which comes from the lamp and is reflected from the objects we wish to see. Sunlight comes from above, and this is the most agreeable source for any light, for our eyebrows and eyelids shade the eyes from the direct glare. The light from the sun is well diffused by the earth's atmosphere through which it passes, artificial light coming from a point should be shaded

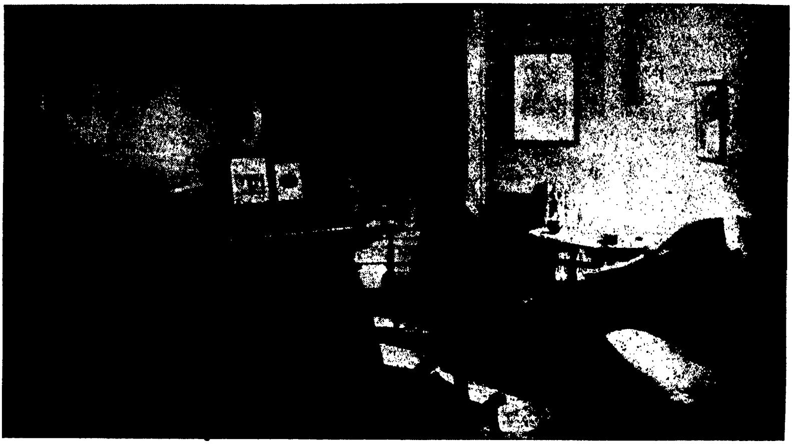


FIG. 77.—A room with direct and local lighting.

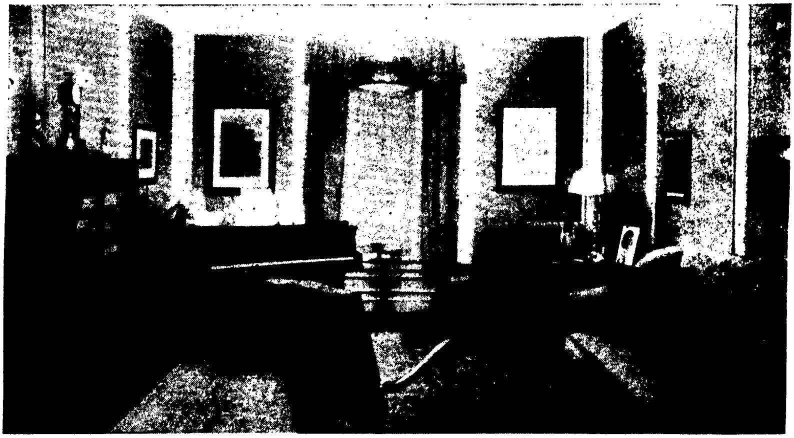


FIG. 78.—The same room lit by the semi-indirect system.

and softened to diffuse it, and the source should be placed high enough to be out of the line of vision. A bright light in the field *of vision makes it difficult to see the objects which it illuminates* because the pupil contracts to keep out most of the glare, and so less bright things become less visible. Light should be judged by the way it helps one to see, not by the brilliancy of the source.

Indirect Lighting.—A very satisfactory way of lighting a room is by the indirect system. The source of the illumination is screened by opaque inverted bowls lined with reflectors which send the light to the ceiling, which must be very light in color, and from which it is reflected downward. There are other forms of hidden lighting besides this. The lights may be hidden behind a moulding near the ceiling or by other novel devices. Well-lighted display windows with their hidden lights are good examples of indirect lighting. It requires more candle-power to light a room by indirect lighting but the method is a more satisfactory one.

In Fig. 79 is shown a room illuminated in part from overhead by light from outside the room, the source of which is in the overhang of the roof. This is not indirect lighting, for the light sources are visible. Some indirect light comes, however, from a source within the room at the left.

Semi-indirect Lighting.—A combination of direct and indirect lighting, semi-indirect lighting, is attained by placing the lamps in bowls of diffusing glass; part of the light is reflected to the ceiling and then down and part is diffused through the bowl.

Direct Lighting.—The light may come from lamps in overhead fixtures, in wall brackets, or in portable lamps. Lamps in wall brackets may be ornamental but in a large room they are not very useful because their situation so close to the wall prevents much light being thrown into the room, and since they are at eye level they must be well shaded. Any lamp in the line of vision should be shaded to prevent injurious glare. Overhead lights do not come within the line of vision as often as bracket and portable lights and they are less likely to come into view at close quarters. The shape of a shade should depend upon whether the lamp is overhead, level with the eye, or below eye-level, for the shade should hide the light when viewed from the angle from which it is most the lighting of the house, if the system is to be electric, outlets for electric fans, heaters, cooking utensils and power machines must be planned for, as well as the light outlets, and the house wired accordingly. Switches should be placed so the light may be turned on without one's having to traverse a dark area to reach the lamp or the switch.

Electric Lamps.—The best electric lamps we have at present are the tungsten lamps. Their globes are sometimes filled with inert gas; these give better service than the vacuum lamps; they cost less and the light is more nearly the color of daylight.

There are daylight lamps with pale-blue globes. They give a white light better for working by than the yellow light which we associate with rest and recreation.

In cities and towns electricity is the commonest illuminant and even some isolated houses have their own electric lighting systems. In general we find in rural districts the kerosene lamp; in some cases a gas or a gasoline lamp is used.

Electrical Installations.—A private electric system requires an electric generator and power to drive it. Unless water-power running twenty-four hours a day is available a storage battery is necessary, for a small private system does not warrant running the engine all the time. The size of the generator and that of the engine necessary is determined by the maximum horse-power required at one time. Many companies put out generating plants which are operated with the minimum of care. The standard 110-volt equipment should be chosen rather than a low-voltage generator, especially if electricity is to be used for power as well as for lighting. With this, standard lamps and other appliances may be used, and standard repair parts are easily secured.

An experienced person should be secured to install the plant and to do all the wiring, and the owner should have this work inspected by another expert, for many fires originate from defective wiring.

Gas.—With gas as the illuminant, mantle lamps are far superior to the open-flame burner. These may be had in the older upright style and in the inverted style which does not cast a shadow from the fixture as does the upright one. The gas used in a gas lighting system may come from the city mains, may be generated in a small private plant, or may be bought bottled in condensed form. Natural gas, coal gas, and oil gas are the kinds we usually find in city gas plants. Acetylene and gasoline gas are the kinds most often generated in small plants. Blau gas, an oil gas, when subjected to pressure liquefies and may be bought in bottles for use with proper fixtures in the isolated house. One gallon of liquefied gas yields twenty-eight cubic feet of expanded gas. Any of the above gases may be used for heating or for cooking as well as for illuminating. We sometimes find a prejudice against the use of these because they are considered unsafe, but the best types of plants are not dangerous and are approved by the National Board of Fire Underwriters (76 William Street, New York City). Its list of approved manufacturers is frequently revised and may be obtained on application.

PROBLEMS

1. In placing lights down a long corridor in a hotel, with transoms into the bedrooms on either side, would you prefer that the lamps be placed at regular intervals, or on what other basis would you prefer to have their locations worked out?
2. Observe lighting installations and look for direct, indirect, and semi-indirect lighting systems.
3. Study the placing of lamps in the living room, dining room, kitchen, and bedroom of the house you live in. Could it be improved?
4. Look through advertising sections of farm and home journals for advertisements of lighting plants. Write for the circulars descriptive of some of these, and select the one you think would be best.

*5. Analyze the lighting requirements in the house you are planning for each room and for halls, porches and basement.

*6. Secure catalogues of electrical equipment desirable for the house, select from these the articles you would like to have in your house.

*7. Trace your floor plans and on the tracing locate all lights, switches and power outlets.

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*The starred problems are those of a connected set running through the book.

CHAPTER IX

BUILT-IN CONVENIENCES AND LABOR SAVERS

There are a number of convenient arrangements which may be built into the house if they are provided for in the plans, and others which may be installed later.

Garage.—A garage, made part of the house and heated, is not only a great convenience, but frequently contributes to the appearance of the place by doing away with the small separate building, and by adding to the mass of the house (Fig. 80). The greatest convenience is attained when there is an entrance from the garage into a hallway of the house rather than into the kitchen or any other room (Figs. 16 and 32).

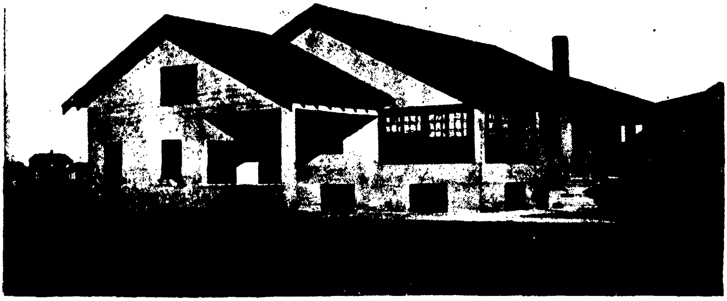


FIG. 80.—The garage a part of the house. Foundation plantings and shrubbery would add much to the appearance of this house.

Chutes.—A coal chute is the best means of getting coal into its place. The coal chute door is either made of solid metal or it is glazed like a window so that when closed the chute admits light as does an ordinary cellar window. The door is set into the basement wall above the grade line. When the cover is opened, an inside hopper is pushed forward thus making a chute through which the coal can be discharged into the bin. When the cellar is entirely below ground, a grade line chute must be used. The hopper extends through the wall and into the ground outside, and this portion is covered by a heavy metal door which is opened to admit coal.

An ash chute from the stove or fireplace to a receptacle in the basement or from a fireplace opening outside saves carrying ashes and prevents scattering dust. Both shaft and ash-can must be so enclosed as to confine all the dust to prevent its escape into the basement.

A clothes chute from the top of the house to the laundry is a common device and a good one. This should run to the laundry from the bathroom or a corner of the upper hall, and, when possible, through the kitchen or pantry so that it may be used for soiled table linen. This chute must be as nearly straight as feasible and without sharp angles to prevent clothes catching in it.

Less common but equally convenient is the dust chute from the top floor to the basement. This must be well built and carefully lined, and must empty into a receiver through an opening in a tight cover; otherwise the dust will be scattered through the house.

Clothes and dust chutes may act as flues in case of fire and so add to the fire hazard. To minimize this danger all openings into these chutes should be closed by doors with springs which prevent their being left open, and the chutes should be of metal.

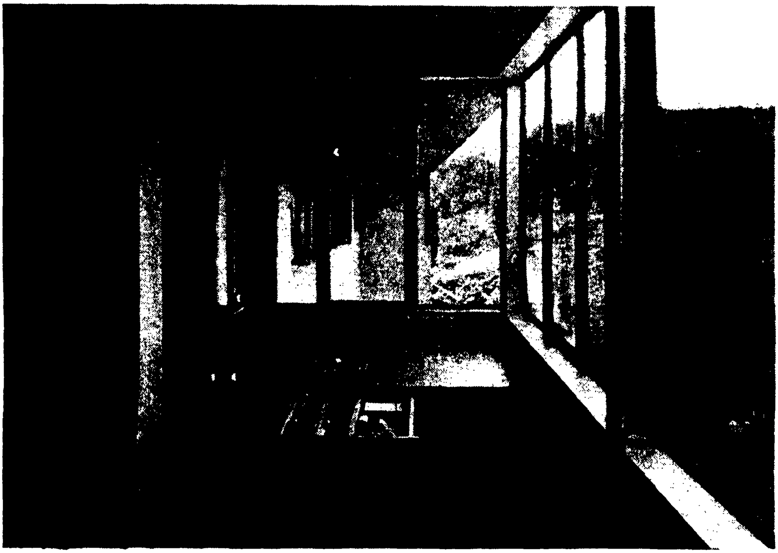
Mail-chutes, or rather boxes for the reception of mail, protect the mail from storm and from rifling. The postman puts the mail through a slot into a box from which it can be removed only from inside the house.

For garbage chute see Kitchen Equipment, page 137.

Closets.—It is an advantage in every house to have certain closets in addition to the bedroom clothes closets.

A broom or cleaning closet need not occupy much wall space, for three feet wide by eighteen inches deep is large enough for all the cleaning equipment. A height of six feet is required to allow for the hanging of long-handle brooms and mops, with a shelf above them on which to keep the cleaning preparations. The mops and brooms may be suspended from hooks fastened to the under side of the shelf, and the dust pan, brushes, and so forth, hung on hooks on the back wall. If no room can be provided for such a closet, a cleat about three inches wide, nailed to the wall with hooks screwed into it, affords a place where the mops and brooms may hang.

A coat closet near the entrance is desirable. If it is to be used by children, it should be fitted with hooks and a coat bar placed low so that the children may hang up their own wraps. A shelf may be provided above for hats and other things, and a shelf or a rack below for overshoes and rubbers.



Richard J. Neutra, Architect.

FIG. 81.—Sewing-corner in a steel-built house with slide-out electric machine and convenient storage compartments.

Bed-linen, blankets, and similar household furnishings are best kept in a linen-closet in the bedroom area of the house. A part of this closet may be a tight, well-made cabinet with a tight door which will not admit moths, to be used for storing blankets and other woolens which are not in use. Towels, soap, toilet-paper, and sick room supplies may be stored in this closet or in one in the bathroom.

In a small bathroom where there is no room for shelves or dressers in which to keep supplies and toilet articles, we find as a rule the medicine closet in which small toilet articles are kept.

This closet is usually furnished with a good mirror fastened to the door and with adjustable plate-glass shelves to facilitate cleaning.

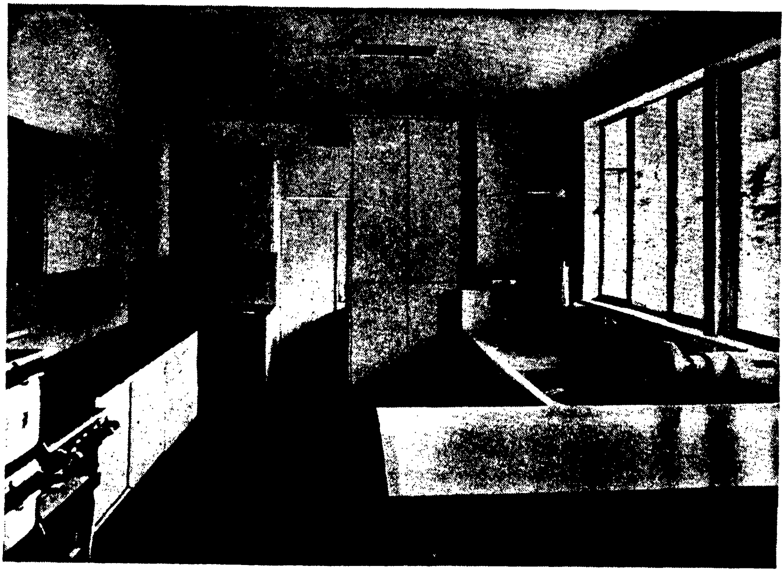
In the household in which much sewing is done a sewing closet or cupboard affords storage space for sewing equipment, dress form, patterns, partially made garments, and supplies. A sewing corner or alcove with built-in table and convenient drawers and storage space to the left under a stairway is shown in Fig. 81. An ordinary closet, which is three and one-half to four feet deep and five or six feet long and has a window, may be fitted up as a sewing room with a folding ironing board and cutting table one or the other of which might be hung on the inside of the closet door to be used when the door is swung open. A portable cabinet, with conveniently arranged storage space for equipment and supplies for sewing and millinery work, designed by Ella M. Cushman, is described and illustrated in a bulletin from the New York State College of Home Economics.

Clothes closets may be fitted with shoe-racks, hat-rests, cupboards, drawers, and coat hanger rods. A safe is sometimes installed in the closet of the principal bedroom.

A mirror door in a bedroom is very convenient and saves the space which would be taken by a cheval glass (Fig. 86). The glass may be on the outside or the inside of a closet door. An arrangement of two mirrored doors swinging in opposite directions with a mirrored panel between makes a fine triple mirror.

Kitchen Equipment.—A package or milk receiver which protects packages from thieves and animals, and from exposure to sun, rain, and freezing temperatures is a convenient device. It consists of a metal body the depth of which equals or exceeds the thickness of the wall, with a door to the outside and one to the inside. The doors are arranged to lock automatically and can be unlocked only from the inside. This allows milk and other things to be put into the house without being carried in by someone. A small slide in the outside wall with a table or shelf on the inside is nearly as good. It should not be large enough to admit the entrance of even a small child. Instead of either of these devices, a compact wooden closet of some kind can be placed on the back porch to receive the incoming supplies. Such a closet should have a door equipped with a spring to close it and shelves deep enough to receive quite large packages.

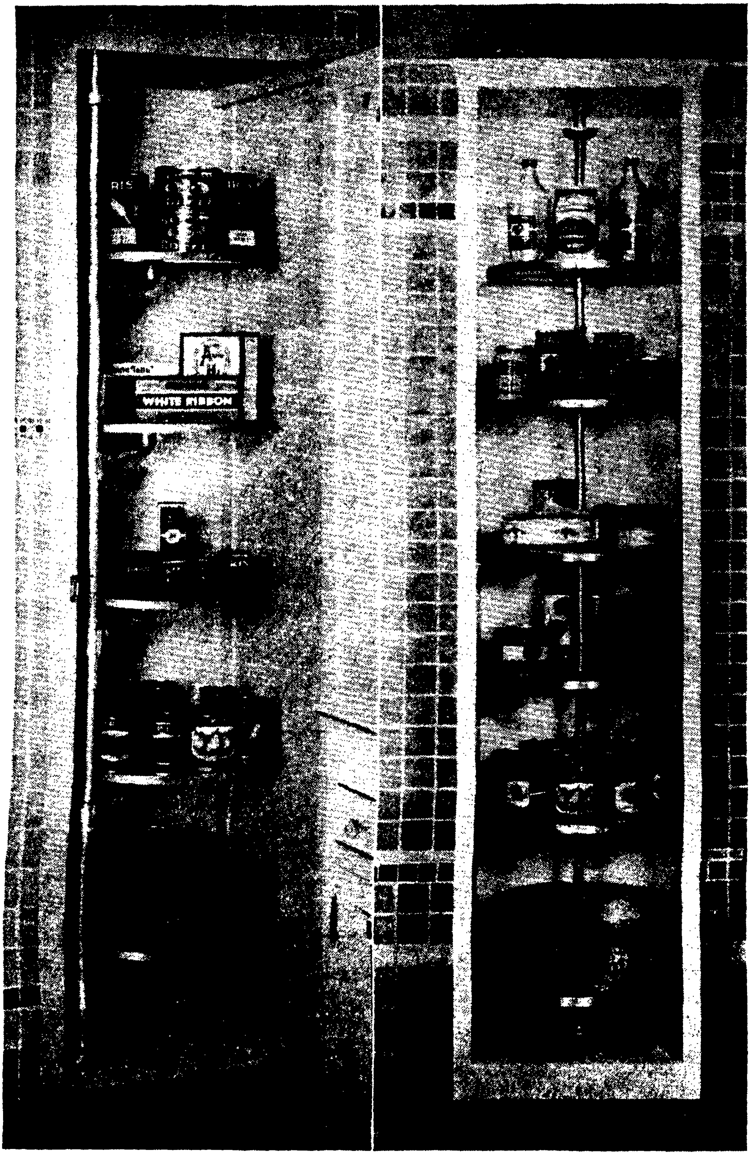
The kitchen must contain ample food storage space (Fig. 82). Usually built-in cupboards, a closet perhaps, and a refrigerator provide for this. The thrifty housewife can manage without a refrigerator for part of the year at least, if she has a cold closet, a cooler, or a cool basement.



Richard J. Neutra, Architect.

FIG. 82.—Kitchen in a steel-built house viewed from breakfast nook in foreground. Chromed hopper door above far end of drain board leading to refuse drying and burning incinerator. Electric kitchen-aid at near end of drain board. Electric exhaust in hood over range. Table tops of acid-resisting formica. Electric dishwasher. Roller screens.

The cold closet is a box set into the outer wall of the kitchen with an opening into the kitchen like a window casing. It extends through and a little beyond the outer wall and has a sloping roof to shed the rain. A door is made to fit the opening into the kitchen. Holes for ventilation are bored through the lower shelves and at the top of the outside wall, these being protected by screen cloth. The best location for such a closet is on a north wall in the kitchen or pantry. A cupboard like the one just described can be made from a box which is fastened into a window just outside the lower sash, which when raised gives access to it.



Courtesy E. S. Roberts.

FIG. 83.—Ant and vermin proof revolving shelves. In one case the shelves may be swung from the cupboard into the room. This cupboard is a cooler with air entering through the slatted bottom.

A draught cooler is a cupboard with screened openings at the top and bottom. Cold air from outside or from the basement enters at the bottom, while the opening at the top permits the escape of warm air. In Fig. 83 is shown a cooler which is ant-proof. Air is admitted through the slatted bottom. At the top and the bottom of the rod supporting the revolving shelves are cups kept filled with oil to keep vermin away from the food. The shelves in this cooler are supported by a rod at one side and may be swung out into the room. It is easy to reach any article in the cooler because of the revolving shelves. Some of the items shown are not things which need to be kept cool. A similar arrangement with the revolving shelves supported by a central rod is also illustrated in Fig. 83. This cupboard is not a cooler for there are no openings for ventilation.

A good cold-storage room for vegetables, fruits, and other winter supplies may sometimes be arranged by walling off part of the basement. This room should be cemented, well ventilated, provided with artificial light, and arranged to be kept dark when desired. Sometimes the proper temperature cannot be secured without excavating a storage room deeper than the basement. A dumb waiter from the kitchen to the cellar facilitates the transfer of supplies.

The built-in work table in the kitchen or the pantry makes it possible to use space economically. The sink may be made part of the table and all the arrangements found in ready-made kitchen cabinets may be utilized, together with any which are the builder's own ideas. Height and width of shelves have been discussed in the chapter on planning.

Towel racks which when not in use may be folded into a small cupboard are liked by persons who are desirous of having the kitchen make the best appearance.

The electrically operated dishwasher is certainly of value when there are many dishes and some housewives consider them worthwhile for a small family. The space under the sink may be enclosed by doors with narrow shelves and racks on the inner sides for holding soap, cleaner, scrapers, and other equipment for dishwashing. When the doors are opened these are swung into view and within easy reach.

The disposal of garbage is a problem which may be met by having a chute opening into the kitchen leading to an incinerator or to a can in a cupboard outside the house. Difficulty is sometimes experienced in keeping these chutes clean. The best means of disposing of garbage is by the use of a garbage incinerator. Several forms of these are now on the market, one type being the gas-piped destroyer placed beside the kitchen range. The burners should be so powerful as to enable even green vegetable garbage to be disposed of in a short time. The ashes are removed from the bottom. This type is rather expensive to buy and to operate. A burning pit of brick or of concrete in the back yard built so that animals cannot get into it provides a cheap and sanitary way of disposing of rubbish and garbage.

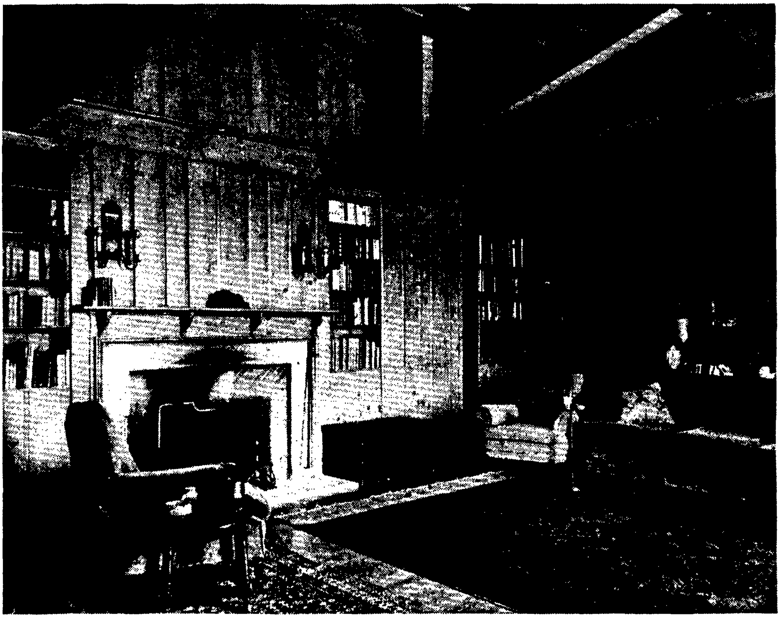
A garbage receiver sunk into the ground and opened by foot power and a lever, prevents the garbage pail from being overturned by stray dogs and is more sightly than the exposed garbage pail. The pail is lifted out of the receiver when it is to be emptied.

When the fireless cooker, gas range, or electric stove is used the problem of keeping food warm and warming the dishes arises. This problem has been successfully solved in some homes by the use of steam or hot-water radiators. A flat-top grill is placed over the radiators in either kitchen or dining room and used for warming dishes. Special pantry radiators which have shelves made of coils are available for this purpose.

It is desirable to have some place in the kitchen or the pantry in which to store the extra leaves of the dining-room table and also suitable drawer space for keeping table linen.

A breakfast alcove may be a fair-sized room with portable table and chairs or a narrow space just wide enough for table and benches, either outside the kitchen or in a corner of it. The alcove may be in one end of a pantry. The seats in the breakfast alcove may be boxes with the tops or the fronts hinged to open. This last arrangement permits of access to things at the bottom of the box without having to remove everything above them. The table and the seats may be hinged to the wall and folded up against it when not in use, or they may fold up into spaces where they serve as doors and behind which are shelves. Such cabinet arrangements may be purchased ready-built. The practice of making the breakfast alcove window a high one is not commendable. A pleasanter arrangement is to have it low enough to allow those seated at the table a view out of doors. In the house of the woman who does her own work, the alcove in the kitchen provides a place where children may play, or a neighbor visit while work is in progress.

Laundry.—A wooden floor built of boards one-fourth inch apart, slightly raised above the cement floor, and placed before the laundry tubs, protects the laundress from contact with the hard, cold, and often wet cement floor. The laundry clothes-drier makes the housewife independent of the weather. The drier consists of a group of galvanized iron compartments each about seven feet high, hung to racks overhead so that one compartment can be drawn out independently of any other. Inside these compartments are rods upon which to hang the clothes. When the compartments are in place a comparatively air-tight cabinet is the result. Heat for drying clothes is furnished by a stove placed beside the drier, which causes hot air to circulate through the drier. The fuel may be either coal, gas, wood, or electricity, and the stove may be used for other laundry purposes (Fig. 22).



Gordon B. Kaufmann, Architect.

FIG. 84.—Built-in book-shelves. This library is in the house shown in plan in Fig. 114.

A cupboard in which the stationary ironing board folds up out of sight when not in use is a desirable built-in feature. A recess in the wall for the electric iron and an indicator to tell whether the electricity is on or off are also desirable. The ironing board may be set in the laundry, the kitchen, or perhaps in a sewing room, or in a second-floor hall. In many cases it would be well when there is an ironing board in the laundry to install a second one near the bedrooms if there is suitable space for it.

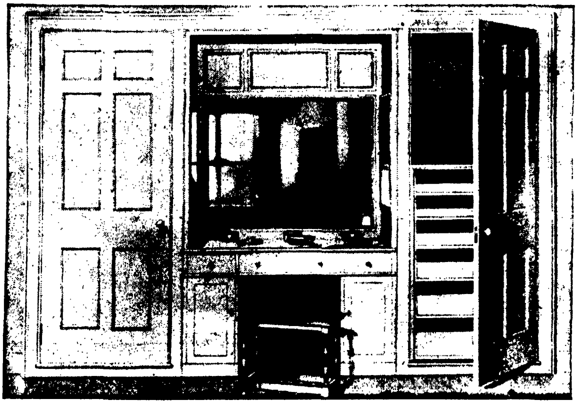


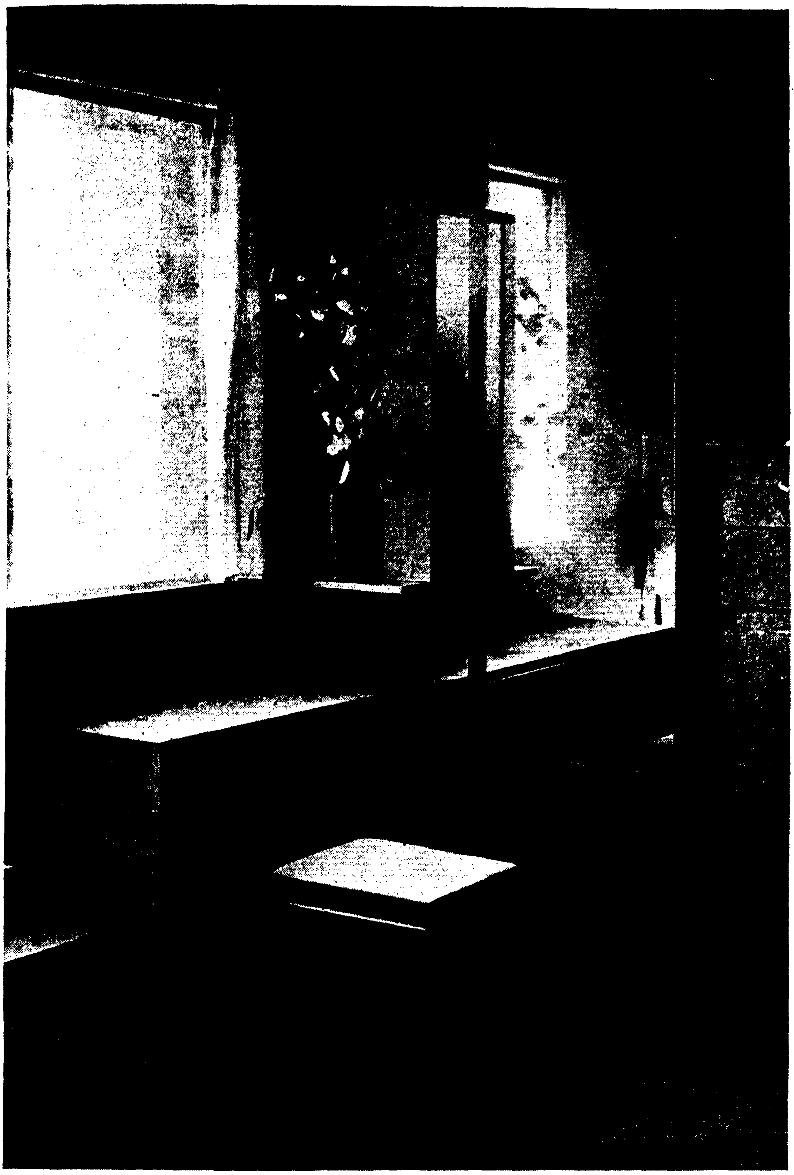
FIG. 85.—A ready-made built-in dressing table, closet, and storage trays.

Living Rooms and Bedrooms.—Built-in couches, beds, dressers, and sideboards are used as well as the more common built-in bookcases (Fig. 84). When the furniture is built to the floor it saves floor finishing and covering as well as cleaning, and often utilizes space better than is possible when movable furniture is used (Figs. 85 and 86).

A fireplace accessory which is a labor saver is a fuel box with a platform which may be lowered to the basement to be filled, or with an opening to the outside of the house through which it is filled.

A convenience which adds to the sleeping space or which makes a living room of a bedroom is the wall bed. This folds up and is swung into a closet or it slides back into the wall, perhaps under a closet raised a few feet from the floor.

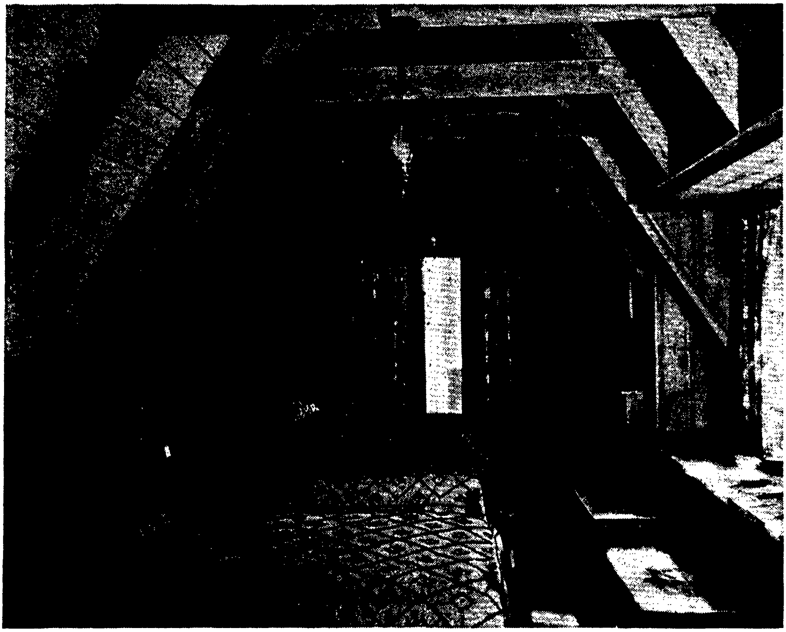
Miscellaneous.—Waste attic space may be utilized in bed-



R. M. Schindler, Architect.

Fig. 86.—Built-in dressing table, chest of drawers, and mirror on closet door in a bedroom

rooms by projecting a built-in dresser or other feature through the wall (Fig. 87). In a small room an entire side may be devoted to built-in closets, dresser, drawers, and bookcases. Space under recessed windows is sometimes utilized by building in a window seat. A chest under such a seat in the dining room is a very convenient place to hold table linen, the under part being used for table cloths and a tray above arranged for doilies. In other rooms the space under the seat may be employed for whatever is most convenient, for instance, for shoes or as a dress box in the bedroom, or for firewood or coal in an ingle-nook. Built-in chests need not, of course, always be under windows. Racks in the basement for vegetables and fruit which permit free circulation of air about the food are convenient as are racks for storing screens during the



W. P. Woodcock, Photographer.
Morgan, Walls, and Clements, Architects.

FIG. 87.—Built-in drawers and dressing table in a dormitory in a mountain home.

winter. The roller type screen is desirable; this is rolled up out of the way when not needed and storage is not necessary.

PROBLEMS

1. Look through magazines for advertisements of labor-saving devices. Send for descriptive material.
2. What conveniences might advantageously be built into the house in which you are now living?
3. Visit furniture shops and study kitchen cabinets. Make notes of any devices you would like to have in a built-in work table.
4. Add to the list of built-in conveniences given in this chapter any others with which you are familiar.

*5. Plan a kitchen work table and any other built-in features you wish for the house you are planning. Make drawings to the inch scale. Show elevation plan and section. Draw to quarter-inch scale plan and elevations for a sewing closet four feet by six feet.

* The starred problems are those of a connected set running through the book.

CHAPTER X

HISTORIC STYLES OF ARCHITECTURE

PART I

ANCIENT AND MEDIÆVAL ARCHITECTURE

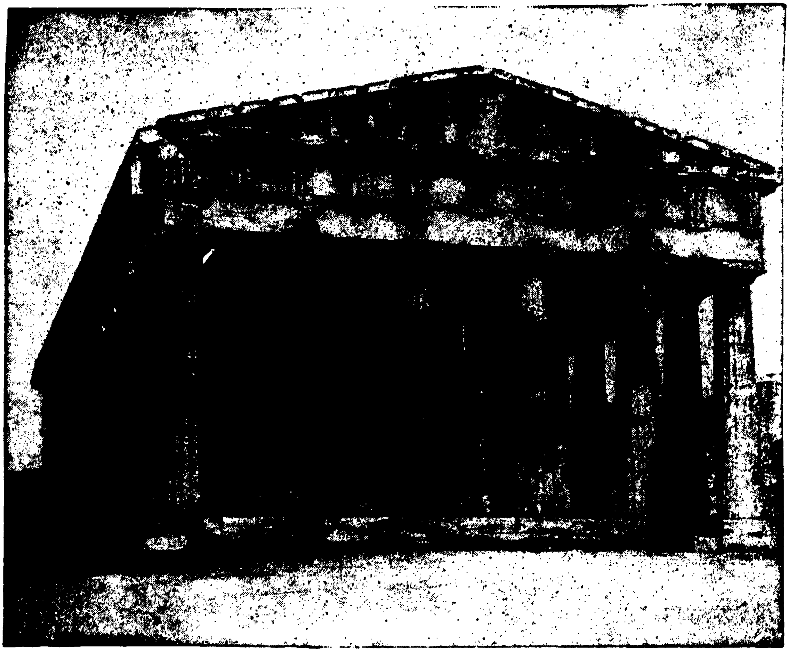
Many persons think of architecture only in connection with monumental buildings but it is an art appropriate in the highest degree to the small buildings devoted to daily use. Architecture, or its lack, in these has more effect upon our lives than in courthouses, churches and theatres. It is not enough to have safe, convenient shelters; we need to be surrounded by beauty as well. In order to gain a basis for good taste in architecture, even if it is to be exercised only in determining the design of the small house, we must study the expressions of architectural principles or laws in the various styles.

Ruskin defines architecture as the art which disposes and adorns buildings so that the sight of them increases enjoyment. Architecture gives pleasure, and there can be no such thing as bad architecture. A structural achievement is not necessarily a work of architecture, for there is no architecture about a building which is ugly. A building may serve no useful purpose, yet it may be an architectural gem. Most of our architecture, however, disposes and adorns buildings which exist primarily for the purpose of sheltering people or things. The primary purpose of a building imposes limitations upon the art which makes it beautiful. The adornment must be in harmony with the whole building, must pervade it.

Chief Styles.—There are four great architectural developments in the Western world, the later ones outgrowths of the earlier, all showing obedience to the laws of beauty and to the principles of good taste, upon which, to a considerable degree, the present European and American developments are based. First, there is classic architecture as exemplified in the remains of Greek and Roman structures. Then comes the sturdy Romanesque, built up, as it were, from an inheritance of fragments of the classic styles and materials, skill in handling which had been lost in a dark age. Out of this grew the marvelously delicate and graceful Gothic architecture, so different in general aspect from the Greek or Roman, yet showing evident traces of its origin in structure and detail. The fourth architectural development is that of the Renaissance. At the beginning of this period men threw off their accustomed habits of thought and life, and tried to revert to those of an earlier day. In this age men were stimulated to independent thought by the achievements of such leaders as Galileo, Columbus, Bacon, and Luther; their æsthetic sense was aroused and developed by the creations of such artists as Fra Angelico, Michelangelo, and Cellini. The architecture of the Renaissance expresses the spirit of the times in free adaptations of architectural forms from the older civilizations to the needs of the day. Although building and architecture are ancient arts, few records of their development are kept for us in homes, since the homes of most peoples have been of frail structure. To see the development of the styles of architecture we must, therefore, turn to the more enduring structures, such as temples, palaces, cathedrals, and other public buildings.

Greek Style.—Greek architecture is the consummate perfection in expression of very simple principles of structural engineering and of ornament. The openings of Greek buildings were spanned by lintels; weights were carried by columns. The column and its entablature, the pediment, and square-headed openings are the distinguishing marks of Greek architecture. The plans are generally rectangular and exceedingly simple. Most of the buildings which have come down to us are temples. These are arranged with a chamber, the cella, at the end of which stood the statue of the deity. The cella opens onto a porch fronted by columns supporting the entablature and the roof. Sometimes the columns form a portico which surrounds the cella, sometimes the portico extends across one end only or across both ends, and sometimes there are engaged columns on the sides.

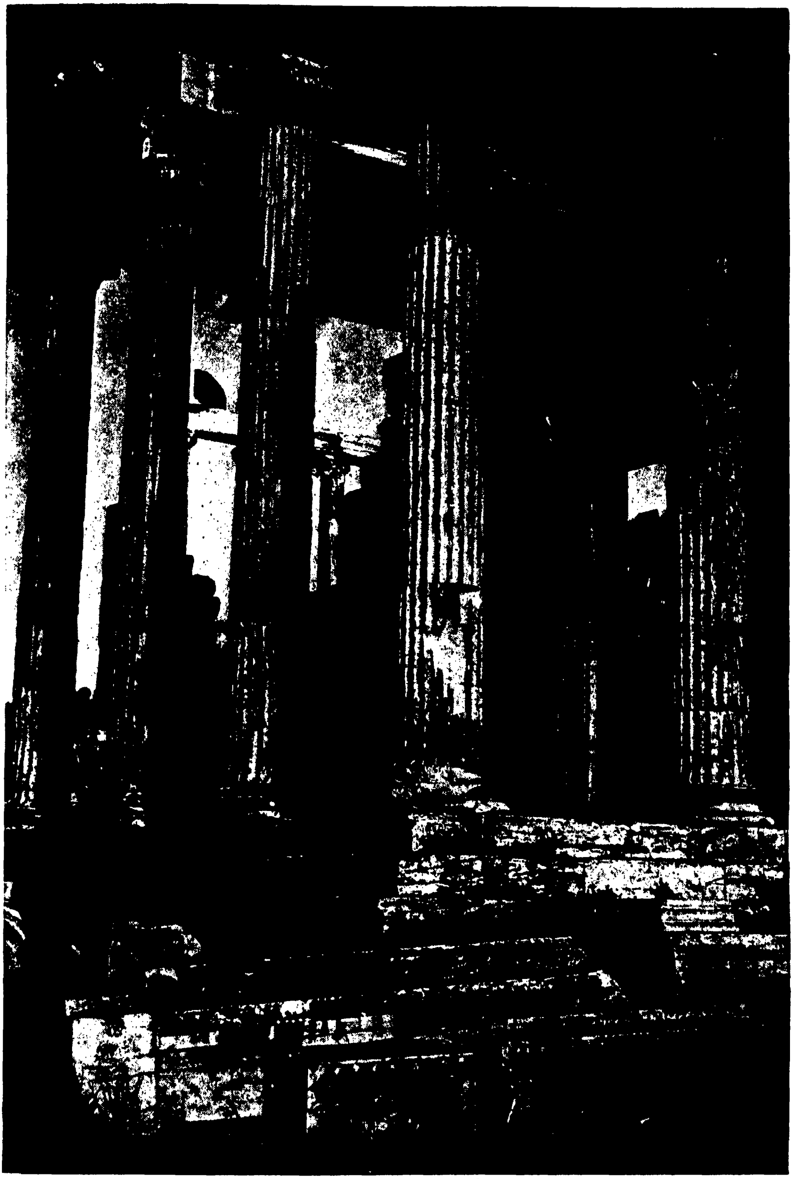
The Orders.—The Greeks used three orders of architecture which are still in use. The Doric is the earliest of these. The heavy columns with their utilitarian but beautiful capitals express strength and simple dignity (Fig. 88). No base is used with the Doric columns. While the order is on the whole severe and heavy, there is no awkwardness; the details are refined and studied, and in harmony with the whole. The column is slightly convex and fluted. The divisions of the entablature, the cornice, the frieze, and the architrave are admirably proportioned. The full moldings are beautiful with these sturdy proportions, and the projections give shadows which reveal the beauties of this order to the best advantage.



From *History of Architecture*, by Sturgis and Frothingham, Doubleday, Page & Co.

Fig. 88.—The Theseion at Athens with a glimpse of the Parthenon crowning the hill in the distance.

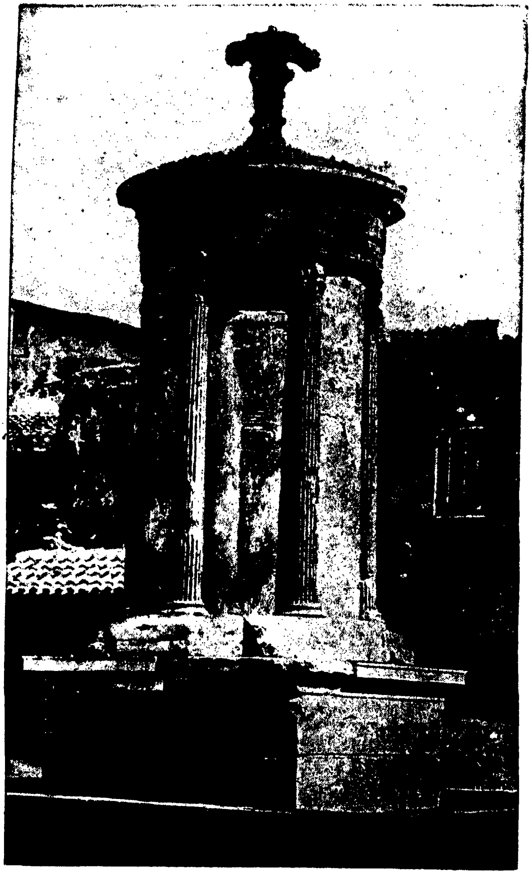
The Ionic order is structurally similar to the Doric, but is more slender and has more ornament. Although different in every detail and in proportion from the Doric, the distinguishing mark of the Ionic order is the capital. The chief feature of the capital is the scroll-resembling member which, resting on the top of the



From *History of Architecture* by Sturgis and Frothingham, Doubleday, Page & Co.

FIG. 89.—The Erechtheion, Athens.

column, ends on either side of it in two downward curving spiral rolls called volutes. The Ionic order has a base, composed of moldings often enriched by flutings or carvings. The entablature of this order comprises a simple cornice, an uninterrupted frieze which is often decorated by sculpture, and an architrave of three plain bands separated from the frieze by a carved molding (Fig. 89).



From *History of Architecture*, by Sturgis and Frothingham, Doubleday, Page & Co.

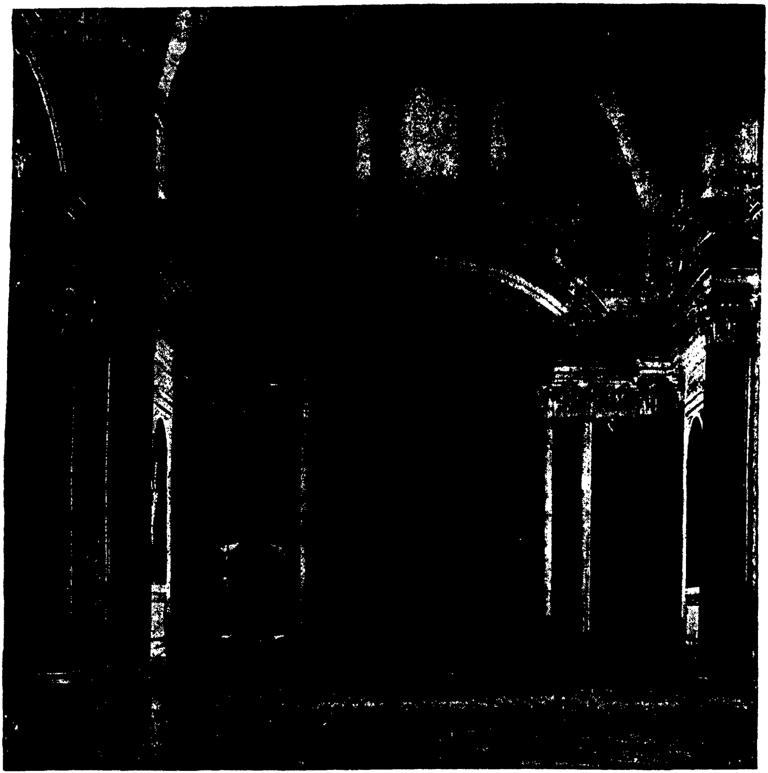
FIG. 90.—The Choragic monument of Lysicrates at Athens.

The Corinthian order is a late Greek development. The proportions are nearly the same as those of the Ionic order, the striking point of difference being the capitals. The Ionic capital is not symmetrical, and the side and corner views are not altogether pleasing. The Corinthian capital remedies this defect. It is deeper than the Ionic capital; it is bell-shaped with one or two rows of upstanding leaves surrounding it, and is crowned by a square abacus supported by small volutes or spirals at the corners (Fig. 90).

Ornament.—The Greeks used few forms in their ornament; the egg and dart, the Greek fret, the water-leaf, the wave, and the anthemion are the chief of these. Their buildings were adorned, however, with beautiful figure sculptures, which filled the pediments and metopes and were carried around the friezes.

Buildings.—Beautiful buildings abound in the Acropolis, the sacred hill of the Athenians and the center of their life. One of these, the Parthenon, a Doric building, is considered one of the most beautiful structures ever built. It has been deemed beautiful by people of many centuries, many lands, and many walks of life. The sculptures of the pediments and those of the frieze, which have been removed, exquisite in themselves, fitted their place in the building and tell the story of the worship of the goddess Athena, to whom the temple was erected. The color of the stone matches the surroundings; the remnants of applied color show that it matched the sky and the colorful shadows cast on the rock by the Mediterranean sun. The building seems to grow and to flower from the rock on which it stands. The Erechtheion, a temple to all the tutelary deities of Athens, is the best preserved of the finer and larger buildings in which the Ionic order was used (Fig. 89). The Choragic monument of Lysicrates is a work of art of unrivalled beauty (Fig. 90). It is small and merely ornamental, yet perfectly adequate to its purpose. It consists of a miniature circular temple less than nine feet in diameter, set on a high base.

The different orders are used in the structures noted, and as the order varies the whole building varies. All the masses of each building, including column, base, capital, and entablature, are in accord with each other. In all of the orders as used by the Greeks there is severe and cold perfection: no matter how much ornament there is, it is never exuberant, but always restrained and delicate. The Greek monuments are comparatively small, of the simplest logical construction, built of cut stone and marble from near-by Paros and Pentelicus; they compel our admiration by their nobility, refinement, and faultless structure and detail.



From *History of Architecture* by Sturgis and Frothingham, Doubleday, Page and Co.

Fig. 91.—One of the great halls of the Baths of Diocletian at Rome, restored as a church. This shows the rich marble and the construction characteristic of Rome.

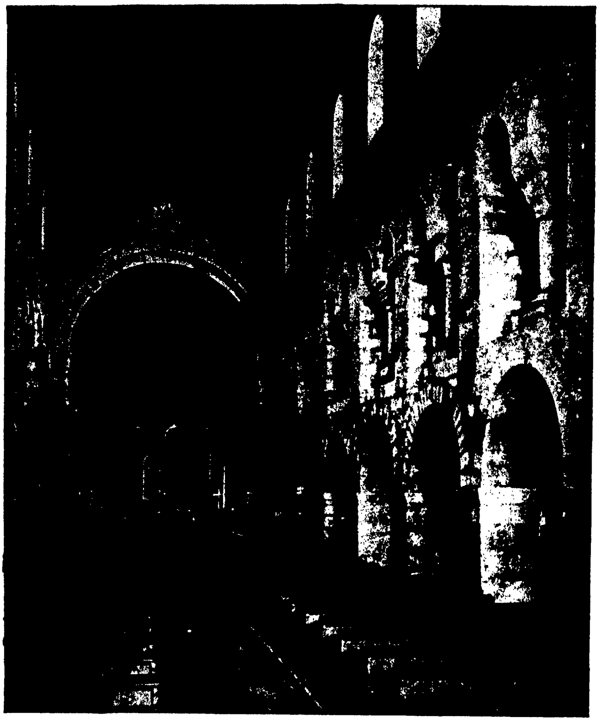
Roman Architecture.—The Romans adopted the Greek orders but modified them. The orders as used by the Romans have not the delicacy and the refinement of the Greek orders. The most commonly used order is the Corinthian. The Romans enriched this late Greek development, added to it, substituted monolithic polished shafts of semi-precious stones for the Greek fluted shafts, and made it essentially their own. Its richness typifies the splendor and glory of the Empire (Fig. 91). The Romans used another order called the Composite which is merely a further modification of the Greek Corinthian.

New Forms.—In these things the Romans borrowed from the Greeks, but they made their own notable contributions to architecture. They made use of a new material, concrete, which lends itself to use by unskilled workmen. They developed the arch, the vault, and the dome, which became more than engineering devices, for the Romans disposed them in such a way that they were decorative features. The use of these new architectural forms led to the repetition of the circle in the plan, in apses, niches, and circular buildings, and to structures of mammoth size in which were achieved a spaciousness never before obtained and a nobility in building rivalling the beauty of the smaller and more delicate Grecian buildings.

Ornament.—In decoration the Romans elaborated a formal system, employing the foliated scroll, grotesques, emblems of the Empire, masques, festoons, and many other characteristic motifs. This formalized and conventionalized ornamentation took the place of the figure sculpture of the Greeks except in those monuments erected as memorials for the great deeds of the conquering Romans where sculpture told the story of their triumphs. Brilliant painting such as we may see at Pompeii, panelling of rich marble, ivory, and gold, and elaborate mosaics employed for walls and ceilings as well as for floors are also characteristic ornaments of Roman architecture.

Buildings.—Most of the Roman structures which remain to us are public buildings, temples, aqueducts, baths, and basilicas. On all these buildings we find the Roman stamp, an orderly arrangement in a monumental form well and solidly built, and some of them we find enriched with distinctive and elegant adornments.

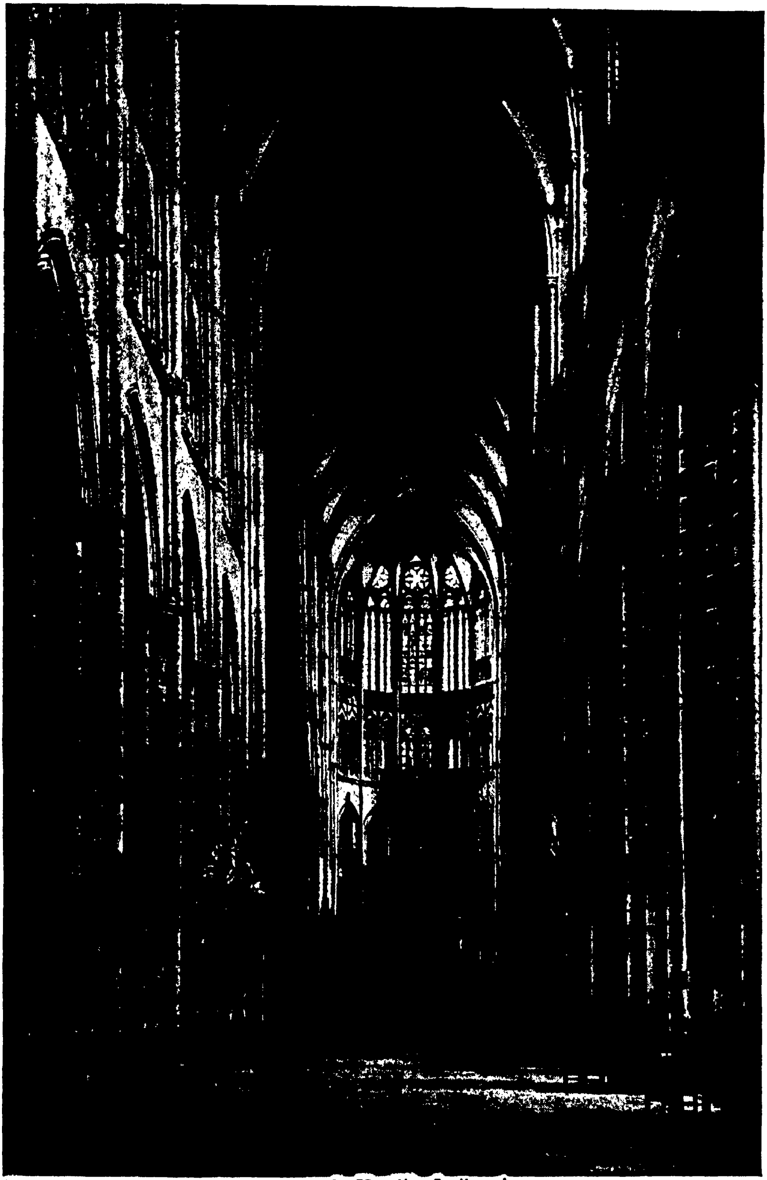
The Basilicas, Christian churches, are late developments modelled after the Roman law courts. The basilica consisted of a nave usually with side aisles separated from the nave by rows of columns carrying walls raising the roof of the central portion above that of the aisles. At one end of the nave was the richly decorated apse, separated from the nave by an arch. At the other end, the entrance, was a porch or forecourt called the atrium. This is the plan of many modern churches. The exterior of the basilica was usually very plain, but the interior was often lavishly decorated.



From *History of Architecture*, by Sturgis and Frothingham, Doubleday, Page & Co.

Fig. 92.—Interior view of church at Vignory, France.

Rome's Legacy.—When the Roman Empire broke up, the laws, the military and judicial systems, the arts of literature and building which the conquering Romans had amalgamated, from their inventions and from their garnerings from other peoples, into one civilization and which they had bestowed upon the conquered peoples, remained, and, without the unifying direction of the Romans, were modified by each people according to its temperament, environment, and traditions.



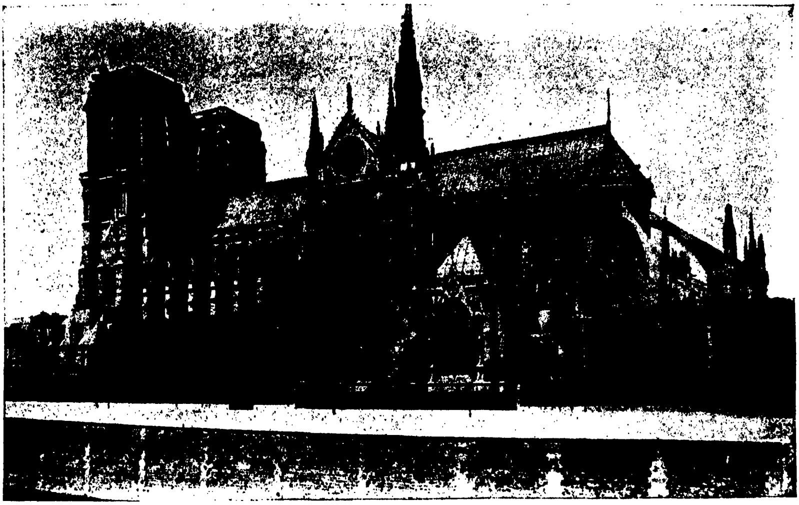
From *Enjoyment of Architecture* by T. F. Hamlin, Scribner's.

FIG. 93.—Interior of Cathedral at Amiens, France.

Romanesque Architecture.—The fall of the Western Empire is dated 476 A.D. The next architectural development after the Roman does not become a recognized style until the tenth century. In the intervening years there was too much misery, turmoil, superstition, ignorance, change, and violence to permit architectural growth. But as Europe emerges from the Dark Ages we find the Romanesque style becoming defined. This is a transitional style (Fig. 92). Romanesque architecture varies in different parts of Europe, as do the later Gothic and Renaissance developments, but the similarities are more marked than the differences, and are due to the Roman traditions and the gathering together of all Europe into the Christian church, which dominated the lives of the people for centuries. The earlier Romanesque structures exhibit attempts of an awakening, unskilled people to express their rather blind aspirations through the bringing together of fragments from the ruins around them. Gradually they evolved a simple, massive, ecclesiastical style of architecture. Its beauty depends upon its simplicity, the rhythm attained by the repetition of some carefully studied elements of design or ornament, the dignity of the well-disposed heavy masses, and the appealing naiveté of the sculptures which told the Biblical stories to an illiterate people. Later developments in the eleventh and twelfth centuries are less unsophisticated but more elegant and aristocratic.

Gothic Architecture.—In the Middle Ages we have in Gothic architecture a perfect flowering in the artistic life of a people. This style is pleasing because of its truth of structure, and because the soaring quality imparted by the vertical lines of pointed arches, buttresses, and spires typifies the aspiration and ambition of the people (Fig. 93). The carvings, crude in detail, told the tales of the Bible or of the guild to those who could not read or write, and so met the needs and limitations of the people in whose time this style developed. Today, unless we look at the details of Gothic ornament through the eyes of the antiquary, we miss its significance, for the purpose which it fulfilled is no longer one of those which modern buildings must serve.

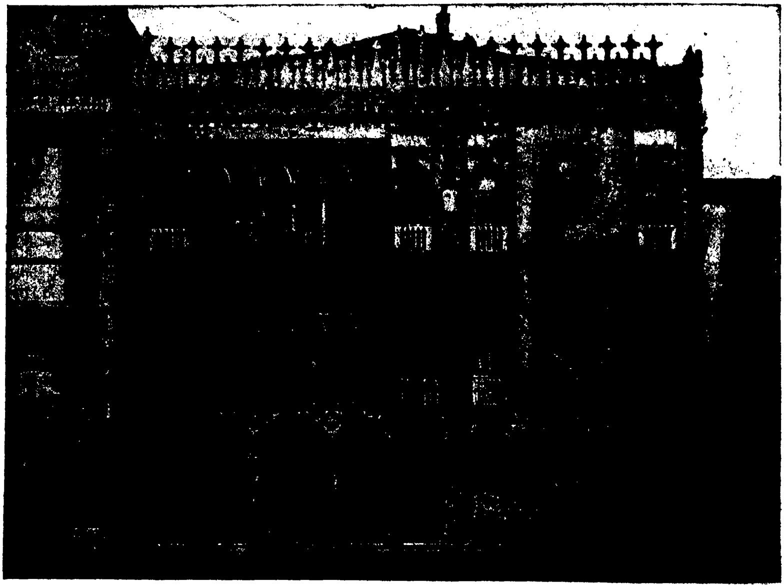
Development of This Style.—Gothic architecture is the result of two things, a mastery over the laws of mechanics applying to structures and the spirit of the times. The problem which led to the development of this style was a roofing problem. The groined vault is more easily built than the circular, and when one vault intersects another it is easier to construct the intersection if the vaults are pointed instead of circular. When this fact was learned the round arch vault was no longer built. An arch, unless monolithic, whether round or pointed, has a tendency to spread apart its supports (this is called its thrust) so that with an arched roof, supporting walls, to resist this tendency, must be thicker than walls covered by a roof supported by horizontal beams. When builders learned that one thrust might be used to balance another, and that with the groined vault the thrusts were concentrated at points, rather than spread along the length of the supporting walls as is the case with circular vaults, they began to use isolated points of support for their roofs. These supports, called piers or buttresses, took the place of the thick walls. The flying buttress was but a further application of structural knowledge, for the nature of the arch thrust is such that it requires less masonry to balance it when most of the support is not directly under the springing point of the arch. Weights on the tops of flying buttresses also



Practical Book of Architecture, Price.

FIG. 94.—The Cathedral of Notre Dame, Paris. Note the good view of the flying buttresses at the right.

helped to take care of the arch thrust. The spaces between the buttresses were filled in with thin walls or immense windows. While in the earlier buildings the windows necessarily let in very little light, the later pier construction allowed the interior to be filled with light. The windows were of rich and brilliantly stained glass, which added much to the beauty of the interior. Thus these beautiful and salient points of Gothic architecture are outcomes of the logical solutions of structural problems (Fig. 94).



From *The Practical Book of Architecture*, Price.

FIG. 95.—The Palazzo della Ca' d'Oro, Venice.

While Romanesque architecture is an ecclesiastical style, Gothic is not, although so many of its remaining monuments are cathedrals. These cathedrals were not, however, merely churches; they were civic centres as well. The cathedral was the throne room of the bishop, who was not only a lord of the church but also a political leader, and a champion of the people against feudalism. These facts were a factor in determining the size of the cathedrals. It was necessary that they be large and light and airy to house the crowds which assembled there. These facts also led to the orna-

Gothic Characteristics.—The general plan of a Gothic building was mapped out on the site, probably by the master-builder, and the details were worked out by the individual workmen. The source of inspiration for decorative detail was usually nature, although grotesques were often used, notably for the gargoyles, the water spouts which carried water from the roof away from the façades. Conventionalized foliage forms however are more common. We also find very splendid figure sculptures on most Gothic buildings. The earliest Gothic structures have a vigor and grandeur which are lacking in the later buildings. This is due to their straightforward structure and to "the dim religious light" which pervades [illegible] development of the style, as supports [illegible] increased and wider windows [illegible] *and dignity is lost in* the [illegible] of the later period. Still [illegible] decadence. The delicacy [illegible] the construction is lost in capricious [illegible] of [illegible] keystones and in over-ornamentation. There [illegible] of repose, and the carvings introduced whenever possible are so delicate that they are not in accord with the structural masses.

PROBLEMS

1. Look for examples of the three orders of architecture in the buildings in your city. Are the columns used as they were by the Greeks? By the Romans?
2. Look for buildings in the Romanesque and Gothic styles or for details of buildings in these styles.

CHAPTER XI

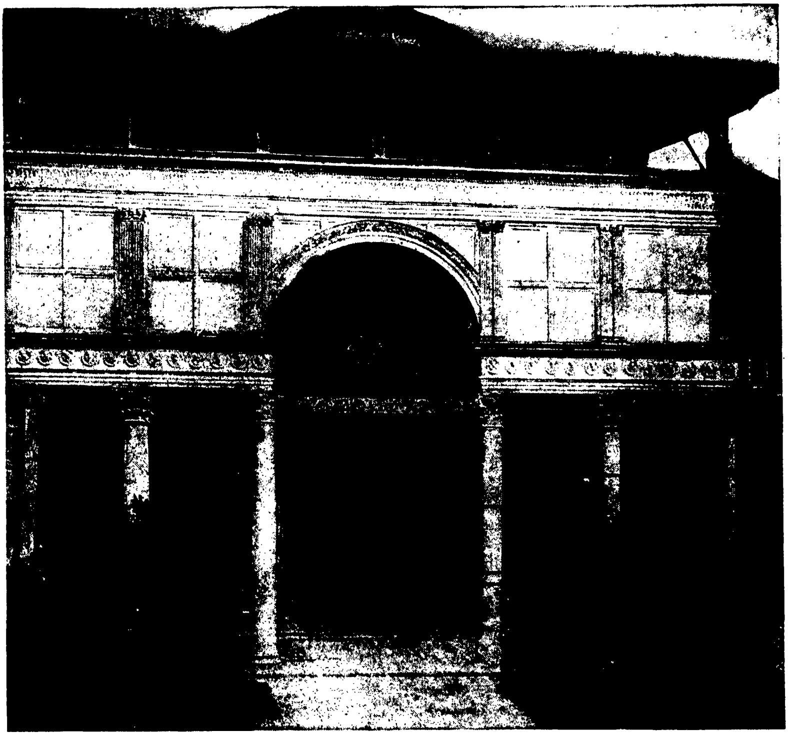
HISTORIC STYLES OF ARCHITECTURE

PART II

THE ARCHITECTURE OF THE RENAISSANCE

The spirit which toward the end of the Mediæval period was manifest in the demand for freedom from feudalism also showed itself in a questioning of all authority and in a search for truth and beauty. This spirit led to scientific inquiry into matters which hitherto had been tabooed by the authority of the church, and the consequent discovery of many natural laws laid the foundation for modern science and civilization. As the new era of emancipation was stabilized men turned to the study of older civilizations. They found inspiration in the artistic works of the Greeks and Romans, and we find them using for the expression of their own lives the classic forms of literature and architecture. This new period, called the Renaissance, began in Italy where classical examples of the arts were at hand and where their influence had been manifest in some degree all through the Mediæval period. Into all arts, however much the artists of this time copied antique forms, they injected much of their own spirit of intellectual and moral self-reliance, independence, and freedom, merged with an intense love for the beautiful.

Architecture of the Renaissance.—There are many variations of Renaissance architecture, for each state evolved a type peculiarly its own, but there are certain features which are universal. Pilasters take the place of the classic columns; the architrave is adopted with all its details; and the pediment or gable, sometimes curved or broken, is used to crown windows and doorways. Façades are flat, broken by doorways and windows, the design, decoration, and disposition of which give character to the façades. Round forms are used instead of pointed forms and the horizontal lines are emphasized as much as the vertical. Much attention is paid to the interiors of dwellings; the decorations are carefully studied and the furniture designed to be in harmony with the room it occupied. In the earliest period of this style it is characterized by spontaneity and originality; in the next it reaches its zenith, but much of the freedom and appealing quality of the earlier period is replaced by formal splendor; and lastly there is a period of decadence, the Baroque or Rococo period in which we find extravagance, sham, and vulgarity.

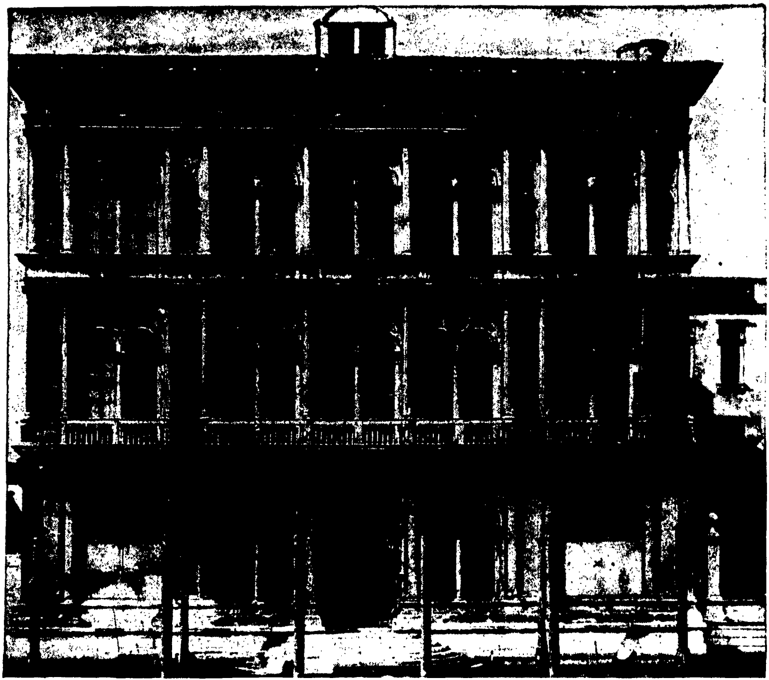


From *History of Architecture* by Sturgis and Frothingham, Doubleday, Page & Co.

FIG. 96.—Pazzi Chapel, Florence.

In Florence.—In Florence we find the best examples of early Italian Renaissance architecture. One of the most generally admired of these is the Pazzi Chapel in the church of Santa Croce (Fig. 96). Brunelleschi, who designed it, was a student of classical architecture. In designing this building he was inspired by

Roman work and in its plan he followed the plan of a Roman temple, such a plan being adapted to the use of this little building; but while he used the elements of Roman architectural design, he put on this chapel the stamp of his own time and achieved a typical Renaissance work of art.



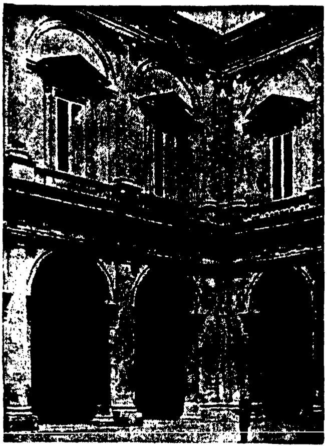
From *Enjoyment of Architecture* by T. F. Hamlin, Scribner's.

FIG. 97.—Vendramini Palace, Venice.

In Venice.—In Venice the new style developed late. We have in the Venetian buildings a richness not found in other Renaissance works, due to the fact that Venice took tribute from the East and that her population was composed in part of daring sailors, and so was less bound by local traditions than were home-keeping Italians. With a lavish supply of marble, mosaic, and money, and with ideas from the Orient, the Venetians wrought magnificently in the new style. The decorative element prevails, but structurally much is lacking (Fig. 97).

In Rome.—The earliest Renaissance buildings in Rome are awkward and clumsy; later the Roman Renaissance culminated in noble palaces and churches. The palaces are larger and truer to the traditions of ancient Rome than are those of other Italian cities. The exteriors are severe, but a regal effect is obtained by the vast size, the great height of stories, the careful proportions, and the perfection of detail (Fig. 98). The interiors are sumptuous with rich paintings and sculptures.

The Renaissance in France.—The new style of the Renaissance was imported to France by the workmen brought back from Italy by the Kings of France. For a time we find it in conflict with the Gothic, prevailing at first only in minor works such as tombs, and in the details of Gothic buildings. Later France made the style of the Renaissance her own, going further than Italy in freedom in the use and skilful adaptation of classic elements, creating a distinctive French style. We find more examples of the French Renaissance in châteaux and palaces than in other buildings.



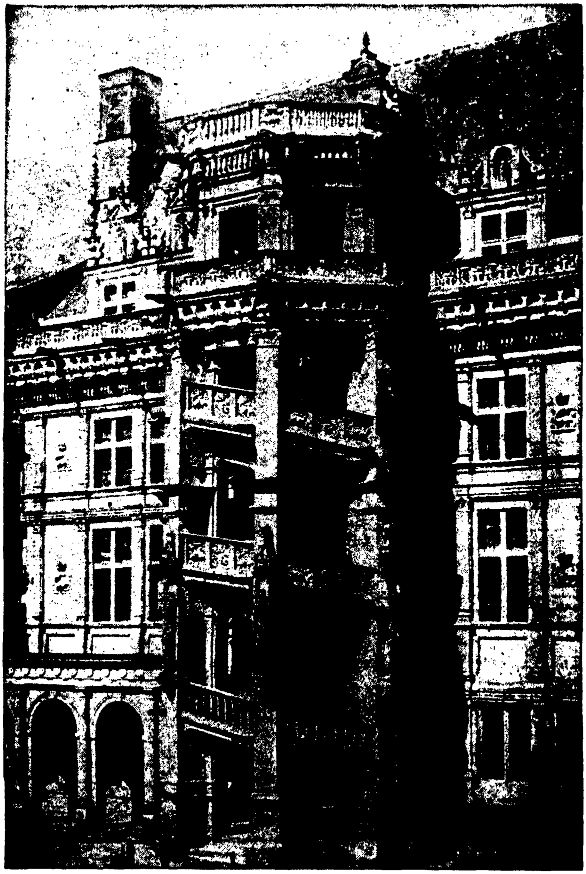
From *History of Architecture* by A. D. F. Hamlin, Longmans, Green & Co.

FIG. 98.—Court of Farnese Palace, Rome.

The Château de Blois is an important example of the transition period. It was begun in the reign of Louis XII and finished in that of Francis I. The famous open stairway (time of Francis I) is distinctly Renaissance, a very free translation of the classic (Fig. 99). The style of Francis I is characterized by the accenting of horizontal lines, belt courses tying together the sills and the heads of windows, and by an almost identical importance given to vertical lines, through the use of pilasters, slender and richly carved, between the windows. Windows were mullioned with fine mouldings, rich cornices, often crowned by a balustrade, and high and steep roofs, broken by elaborately decorated gables, dormers, and chimneys.

The modern use of furniture and furnishings in the styles of

Louis Quatorze, Louis Quinze, Louis Seize, and the Empire has made them well known. The interiors of the time of Louis XIV are less formal and pompous than the exteriors but they are massive and magnificent. At the end of this reign came a reaction against formalism which resulted in the period of Louis XV in interiors extravagantly rich and delicate, but lacking in good structure.

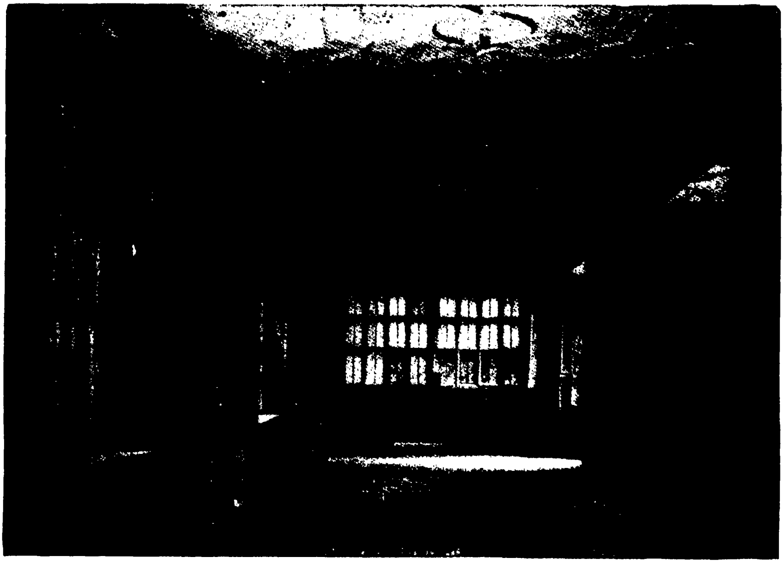


From *History of Architecture* by Sturgis and Frothingham, Doubleday, Page & Co.

FIG. 99.—Open stairway of Château of Blois.

In the reign of Louis XVI we find the most characteristic features to be simplicity, straight lines, and subordinated ornament. The Empire style is plain and heavy, the best of it dignified but much of it ungainly.

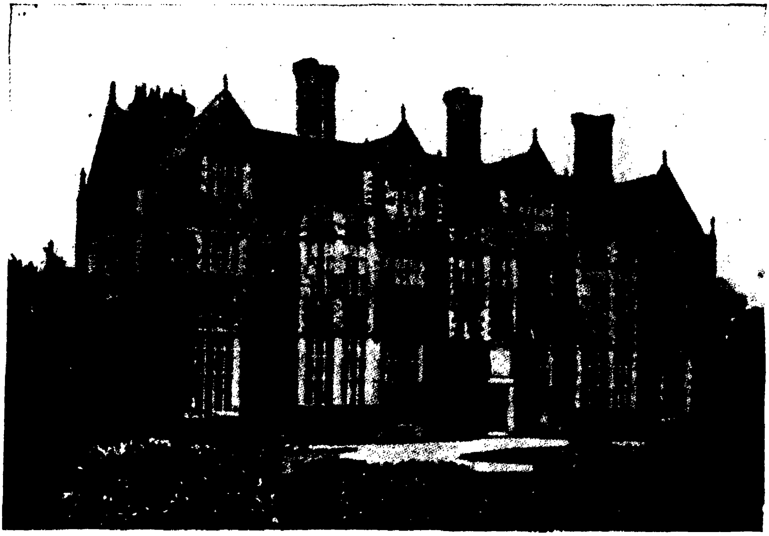
In the other Continental countries of Europe there are few interesting buildings in the styles of the Renaissance. There is not the same fine feeling or taste as in Italy and France; the buildings are in general clumsy, over-ornamented, and show a taste for the outré and grotesque.



From *History of Architecture* by Sturgis and Frothingham, Doubleday, Page & Co.

Fig. 100.—The long gallery of Haddon Hall, an Elizabethan manor house.

Renaissance in England.—English Renaissance architecture and the styles growing out of it have a special interest for us because of their direct influence on early American work. The Elizabethan and the Jacobean styles cover the transition period, when classic details were mingled with those of Gothic origin. The English manor houses of this time and their furnishings are the chief examples of the period (Fig. 100). In the earlier houses, while the English adopted the idea of symmetry, the round arch, and larger window areas than were found in Mediæval buildings, they did not use the orders either as pilasters or columns nor in architraves or pediments (Fig. 101). Local materials were employed, local building methods were continued, and many details were still in the Gothic style. The half-timbered houses of this period have been widely copied in modern work (Fig. 102. See also Fig. 110, a modern house). During the sixteenth and seventeenth centuries as this style developed it became more and more characteristic of the Anglo-Saxon race, and it is in the homes of these domestic northern people that we find the best examples of the architecture of the period.



From *A History of Architectural Development* by F. M. Simpson, Longmans, Green & Co.

FIG. 101.—Moyns Hall, an early seventeenth century building.

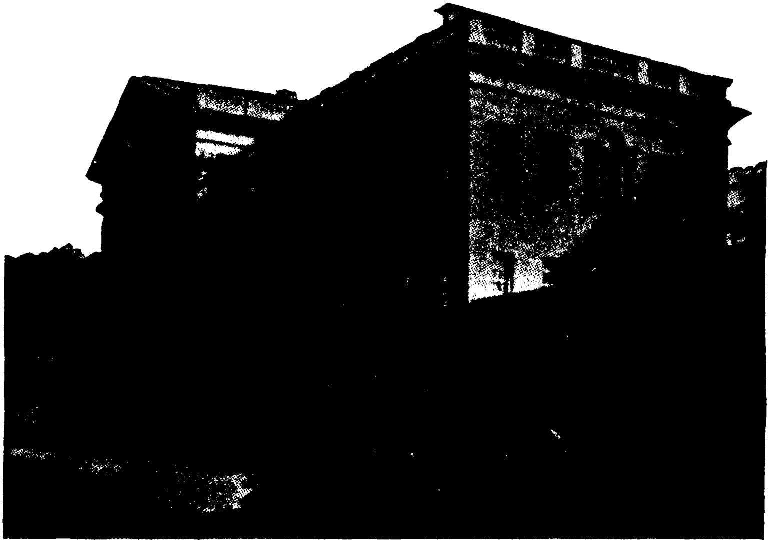
The greatest period of the Renaissance in England was introduced by Inigo Jones, who was succeeded by Sir Christopher Wren. The style of the building inaugurated by Wren and continued by his pupils is called Georgian. The buildings are sober, formal, and dignified, built of brick and stone. The rooms are lofty. The entrance is emphasized by the concentration of ornament at this point, often in the form of a portico composed of columns crowned by a pediment (Fig. 103).

In England we find style in interior design carried as far as or even farther than in France, for in England the architects frequently designed not only the interior structural features but the furniture and furnishings as well. The English styles contemporaneous with those of France are the Jacobean, the style of William and Mary and the Queen Anne style corresponding in time to that of Louis XIV, and in the eighteenth century the Georgian period which corresponds to the styles of Louis XV, Louis XVI, and the Empire. The work of the Georgian period is typified in the styles of Chippendale, Hepplewhite, Sheraton, and the Adam Brothers.

From *A History of Architectural Development* by F. M. Simpson, Longmans, Green & Co.

FIG. 102.—Speke Hall, a sixteenth century house.

Period Revivals.—During the eighteenth century there was a reaction, in all the countries cited, against the excesses of the Rococo into which the Renaissance had degenerated. This reaction generally took the form of a literal copying of the classic for exteriors, behind which were erected buildings which did not fit them. Such exteriors are stately and dignified, but mere masques. There are, however, many examples which have much of the classic spirit and which make use of the classic motives without being senseless copies of the antique. The Petit Trianon at Versailles is a treasure from this period (Fig. 104). In design it is based on classic architecture but it is as entirely French in spirit as the Pazzi Chapel, although based on classic design, is Italian. Each beautiful detail fits into the character of the whole. The Petit Trianon has itself been the inspiration for many modern buildings, but many of these are confused, unrestful, overdrawn, lacking the simplicity and quiet dignity of the masterpiece, because those who planned them borrowed without feeling, and copied parts and details to be applied to their work without putting into it something of their own era to bind the whole. Other antique styles have been revived and dropped. We owe many beautiful buildings in America as well as in Europe to these revivals, but new methods of construction, new civic conditions, new standards of living demand a new expression.

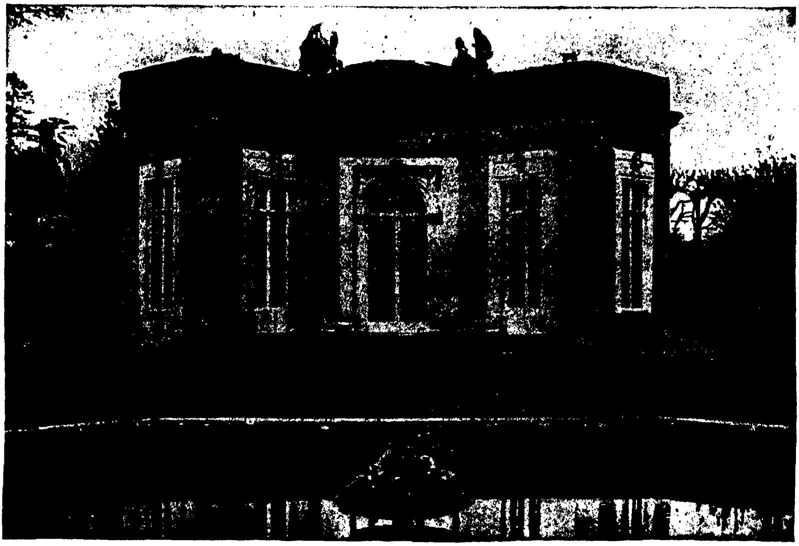


From *A History of Architectural Development* by F. M. Simpson, Longmans, Green & Co.

FIG. 103.—Prior Park, Bath, a Georgian house.

Architecture in America.—In America in the colonies we find many local variations of European styles due to the nationality of the settlers, the materials they had to work with, and their prosperity. Domestic architecture affords the best illustrations, for the colonies were too young for large civic and church buildings, and the time is so close to our own that many of these smaller and frailer domestic structures still exist.

In the East there are two main types of Colonial architecture both derived from the Georgian, which themselves might be called Georgian rather than Colonial. The first of these developed in the north among the Puritans, the second in the south among the Cavaliers. These show how the same architectural elements may be used to express different temperaments and to fulfill different needs. In both North and South there was the same lack of materials, the same distance from the mother country and its examples and supplies, so that we find wood, which was abundant and easily worked, and brick used largely instead of stone, and we find an originality in design of ornament which was forced from the ingenuity of the workmen because of the lack of models from which to copy. These workmen had, however, artistic sense;



Practical Book of Architecture, Price.

FIG. 104.—Petit Trianon.

their stock-in-trade was a knowledge of the orders of architecture, and they took pride in their work, which was done by hand. For these reasons their inventions are pleasing, in good taste, and have besides the charm of individuality. They have left us beautifully designed stairways, mantels, wainscoting, and cornices, sometimes simple but often elaborate, which are admirably executed and exhibit great refinement of detail and charming interpretations of classic motifs (Figs. 105 and 106). Examples of such work are found in all the Colonies.

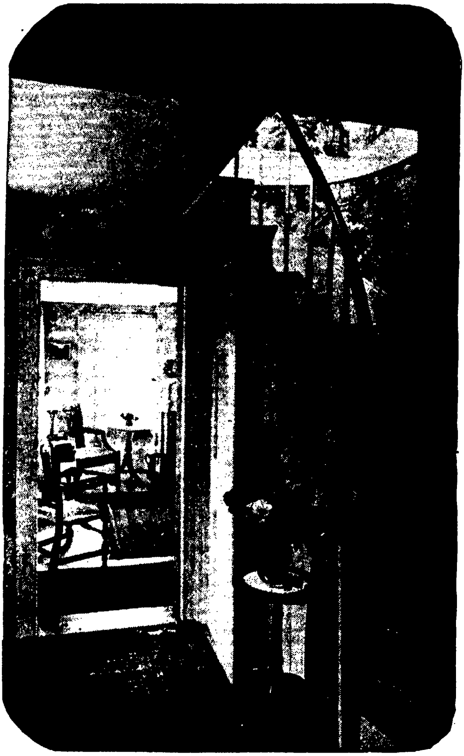


Fig. 105.—A small Colonial stairway.

In New England we find a square house, compact, well built, covered with siding or clapboard, and with a shingled roof. The orders appear in large pilasters extending from foundation to classic entablature and in simpler units in stoops and doorways. The design is severe but well balanced (Fig. 107).

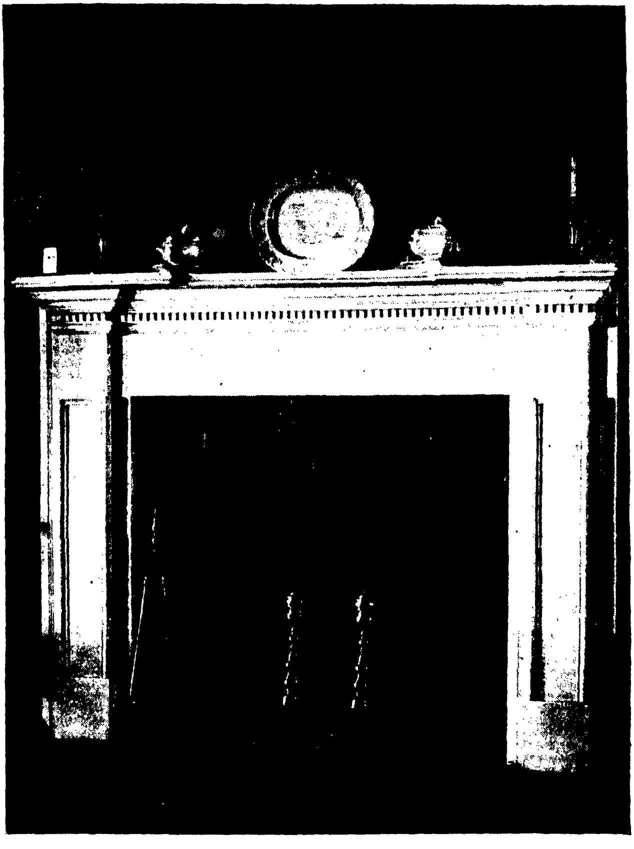
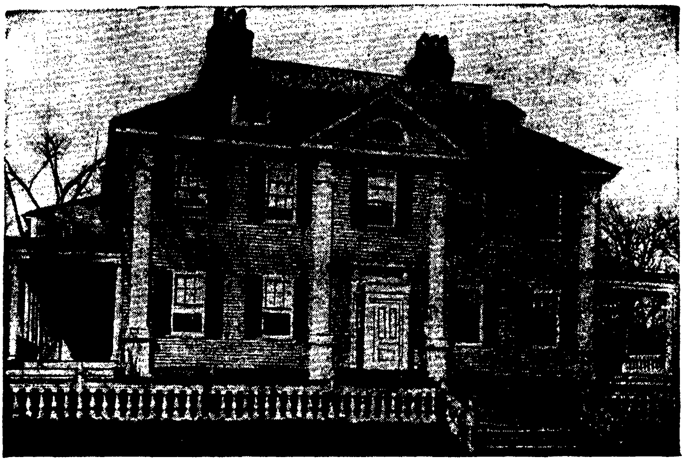


FIG. 106.—A fine, old Colonial mantel.

In the South the Colonial mansions are more stately and less compact than those of the North, reflecting the milder climate and the numerous servants. Brick was most often used, and the setting was elaborated by plantings surrounded by walls with artistic gates. Generally we find the plan to be articulated, consisting of a main portion with a wing on either side; sometimes the wings are on a lower level. Often one wing was used for service and the other was the business office of the master of the house and contained sleeping apartments for bachelor guests. Frequently the kitchen was in a separate building. Verandas with columns two stories high and balconies thrown out at the second-floor level are frequent (Fig. 108).

In New York and Pennsylvania the Colonial type of architecture shows the Dutch influence. The houses were frequently built of brick or of bed-rock when that was available, with the second story under a gambrel roof or with a one-pitch roof which rose from the second floor-line thus making less available floor space on the second floor than on the first. The stoop, a platform at the entrance, with seats at either side, is another feature of the Dutch Colonial house.



From *History of Architecture* by A. D. F. Hamlin, Longmans, Green & Co.

FIG. 107.—Longfellow House, Cambridge, Mass.

In the Gulf states and in the West we find French and Spanish influences. The houses were often built with court-yards or patios which provide pleasant out-of-door privacy, very suitable in these subtropical regions, and with second-floor galleries or porches supported by posts on the ground floor or in some instances by cantilevers. The roof of the gallery afforded welcome shade for the rooms behind it (Fig. 109). The French houses may have two or three stories and are characterized by *delicate iron work in balconies, railings, and other grilles.* In the Southwest the thick-walled, rough-timbered, tile-roofed buildings were bordered on one or more sides by a cloister-like gallery. As a rule they were of one story; sometimes part of the building was two stories in height.

All of these domestic examples of architecture are pleasing for the same reasons as are more famous and larger buildings. They are honest in construction and in the expression of their function; the ornament is structural, there are no shams, and each one is adapted to the climate and to the social conditions of the place in which it is built. Doubtless at all times as at the present there were structures without merit from the point of view of architecture. At certain periods buildings were held in esteem which in later times were found unpleasing. We may take as the test of architecture those qualities and attributes which have called forth the admiration of the discriminating for several generations.

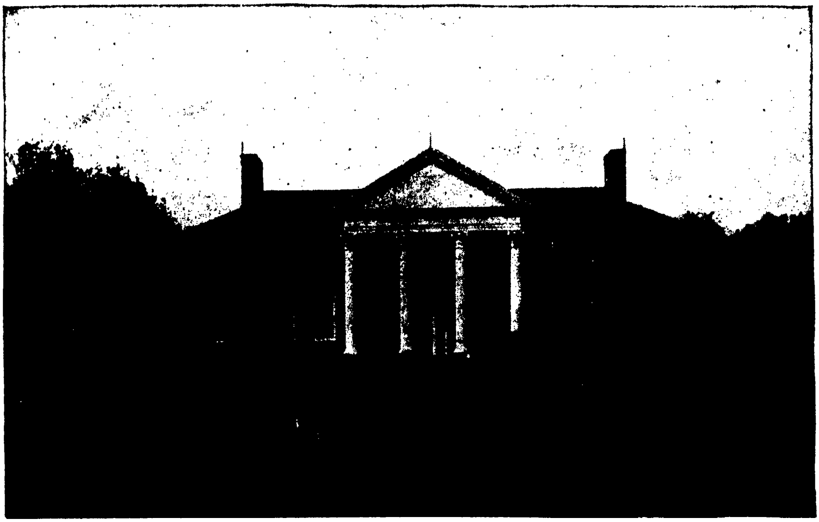


FIG. 108.—Whitehall, Maryland.

Architectural Rules.—From this brief survey of architectural styles of the past the worth of which has been proved by time, we are able to glean some general laws which apply to all buildings in all times, although their expression varies. All buildings must be judged by these rules; they are the criteria of taste.

1. The building must fit its site. The so-called Prairie style of architecture with its strong repetition of the line of meeting of sky and land, which has developed in the Middle West is in harmony with a flat country. A stone house is adapted to a rugged and rocky country or to solid city streets.

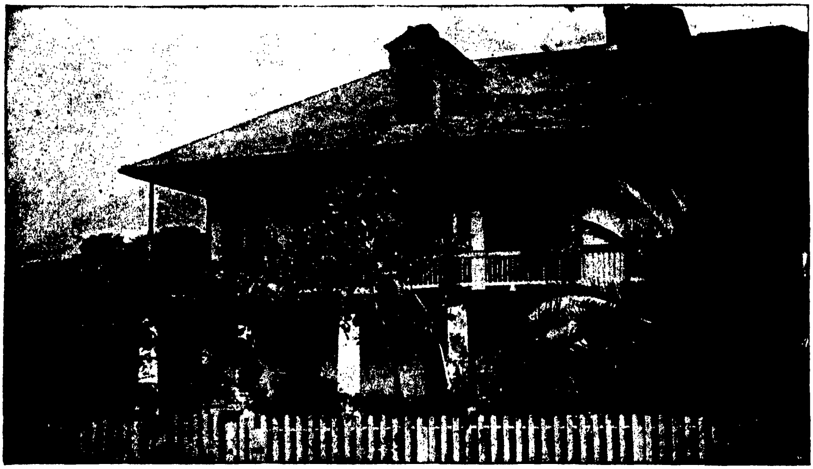


FIG. 109.—An old Louisiana plantation house.

2. A building must serve its purpose; it must be strong enough and look strong enough to withstand wind and storm. It must be adapted to other climatic conditions.

3. A building must express its purpose. We should know at a glance whether we are approaching a church or a residence, a shop or a railway station. There should be no surprise on stepping inside; the exterior should express the interior.

4. A building must reflect the social conditions of the place and period of its construction. A moated castle on Fifth Avenue would be ridiculous.

5. A building must show its construction and be free from pretense, for this is only honest and nothing which is false is beautiful nor can it last.

6. *Ornament must be structural, not applied. No amount of* delicate carvings or beautiful colors can conceal the ugliness of inadequate supports or any other structural defect. Beauty is more than skin deep; the skeleton must be of good proportions and the masses on it proportionately developed, or most of the loveliness of color and texture is lost. Ornament studied in relation to structure, and made part of it, helps to insure beauty in the structure, and is more effective because it does not make of something, the primary purpose of which is usefulness, a background for decoration.

7. Every detail must be in character with the whole; otherwise harmony and unity, foundation stones of beauty, are lost.

8. The plans must be as direct and simple as possible, for the elevations grow out of the plan, and a well-balanced, harmonious structure cannot be built upon a confused, complex plan.

The Supreme Rule.—In this review we find that some of our most interesting buildings are those in which we see the beginnings of a new style. There is a charm about the promise of things to be in these ventures from the beaten path which is lacking in the finish of the perfected style. Considering this in seeking for the most important law of architecture, we find that to reach the best in architecture a building must reflect life and growth, and the condition of a people with ideals making advances for the race.

CHAPTER XII

MODERN DOMESTIC ARCHITECTURE

PART I

THE CONVENTIONAL HOUSE

There are no such striking differences between any of the civilizations which flourished before the eighteenth century as there are between these civilizations and our own. Scientific discoveries which led to a better understanding of nature and of man, and inventions are the roots of these differences.

In the latter part of the eighteenth century movements towards great social changes were progressing fast. Old ideas of the divine right of kings and of the hereditary privileges of an aristocracy were replaced by more democratic ideals. The American and the French revolutions were signal expressions of this. The industrial revolution, today still advancing, threw the economic world into confusion. People crowded into towns and cities and intensified the evils among the poor there. A great humanitarian program began. Slavery was abolished in the civilized world and men were no longer allowed to starve. The modern sanitary movement arose. Cities were cleaned of their rubbish and filth, sewage was disposed of properly, and an abundance of pure water was supplied. There was more leisure for the workers and better health for all. Later came the many applications of electricity to lighting and labor-saving machinery, the telephone, and the radio. These social and mechanical changes are reflected today in the comforts found in the homes of the people and in the projects for slum clearance. In the days of Greece and Rome, in the days when cathedrals were erected, at the time when the palaces of the Renaissance were built, the average man lived in a hovel. Now even the cottage and small apartment are more sanitary and comfortable than the castles and manor houses of earlier days. Many persons however still live under wretched housing conditions in the slums (Chapter XVIII).

In this modern civilization, traditional architectural forms govern most of our domestic architecture. Probably never before has there been as much building of beautiful houses in inherited styles adroitly modified to conform to changes in plan arising from the inclusion in our homes of the modern conveniences and labor-saving machinery (Figs. 110 and 113).

Fig. 110.—This house promises to fulfil all the requirements for the shelter of a fine home where there will be found safety, comfort, beauty and happiness.

Conventional Domestic Architecture.—We can trace the derivation of the conventional domestic architecture of today back through the early American types, or directly to European developments of the Renaissance and of other styles. These earlier buildings have not only been copied but far more frequently they have been cleverly and tastefully adapted. As a result we find a host of beautiful and comfortable modern homes in many of the variations of the Renaissance style of architecture and others, fewer in number, in earlier styles.

In general in the different sections of the country the finer

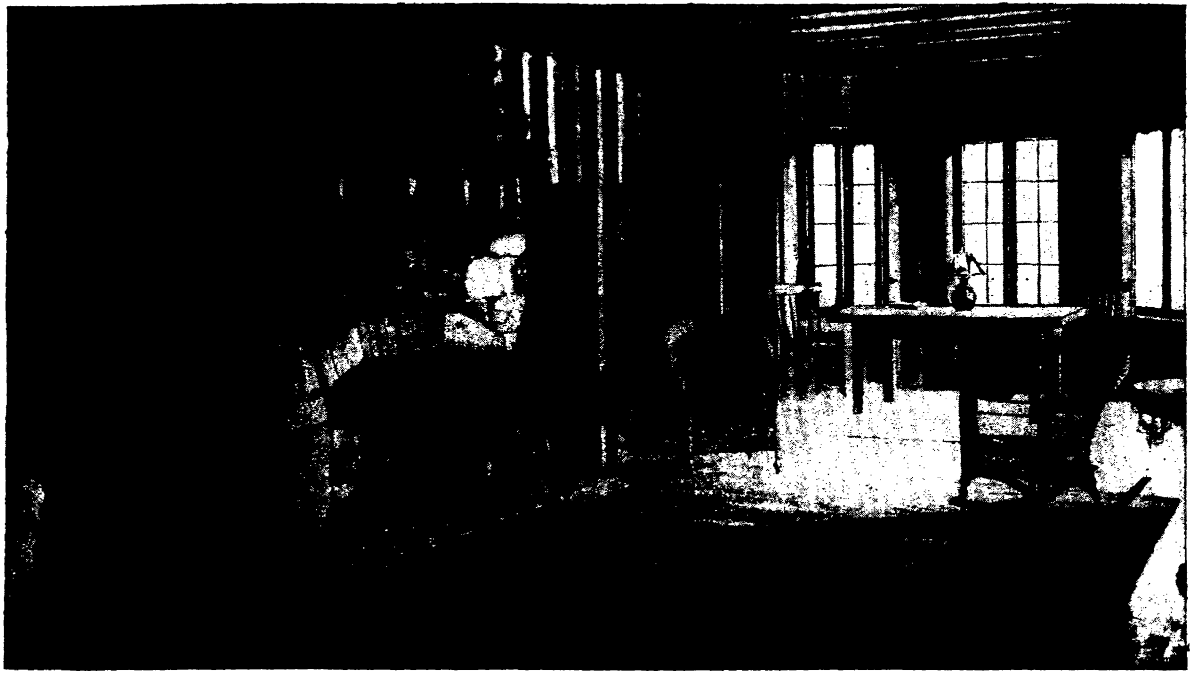


FIG. 111.—The large, rough stone fireplace insures comfort for this living room, the construction and furnishings of which seem to promise a view of a lake or the mountains through the bay window.

old dwellings found there have been the chief source of inspiration. A minor source has been the architecture of countries with similar climatic conditions.

When furniture and furnishings are selected with correct judgment in regard to beauty and propriety, they are in accord with the architectural style of the house. Fig. 111 shows a rustic living room appropriately furnished. Patterning houses after those of earlier days results in a demand for reproductions of the furniture of those days. In some cases the perfection of detail of the large, fine, modern adaptations of historic styles of architecture has led owners to fill their homes with antique furniture and furnishings which must be saved from hard usage. This sometimes serves to dampen the pleasure found in them and to hamper children and young people in their enjoyment of home life (Fig. 112).

In the conservative East, the local Georgian and Dutch Colonial styles still prevail and are more or less faithfully reproduced in houses of all sizes (Figs. 20, 34, 37, 99). In Fig. 113 is shown a view and the plan of a modern home. In the exterior we find an almost perfect copy of a Massachusetts dwelling of an early type. While the plan is that of a modern house well-arranged to meet the necessities of modern activities, it still recalls the plans of the Colonial period (Fig. 154).

In California what might be called the California Spanish style has developed from the suggestions and inspirations found in old Spanish ranch houses and town houses. The four-foot thick adobe walls have been replaced by thin walls of other materials and the windows have been enlarged. With these changes there is in the good work no loss of the simple dignity of the earlier structures, and we have many interesting and attractive buildings of this type. In Figs. 114 and 115 is illustrated a large house which is a free translation of this type. In spite of its size this is a simple and unpretentious house preserving the artless character of the old ranch house. It is skilfully fitted into the site and the materials employed are those procured today at lower cost than those used in the Spanish buildings from which it is derived. Thus it lacks the artificiality sometimes evident in the modern Spanish houses.

All over the country at the present we find the cult of fresh air and sunshine leading people to spend more and more time out of

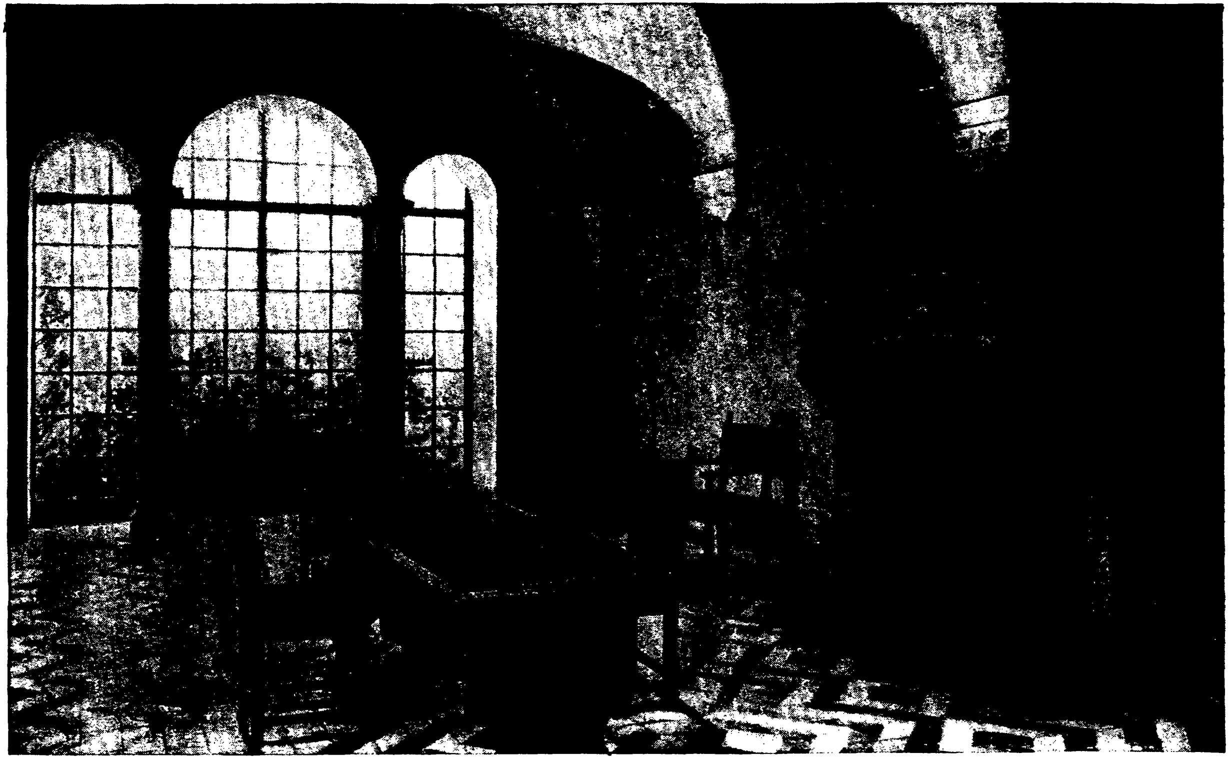
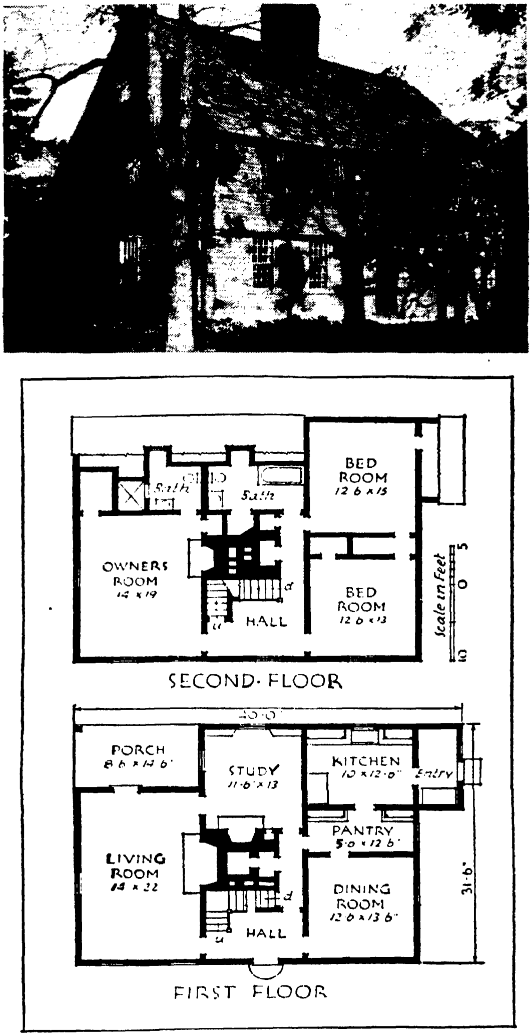


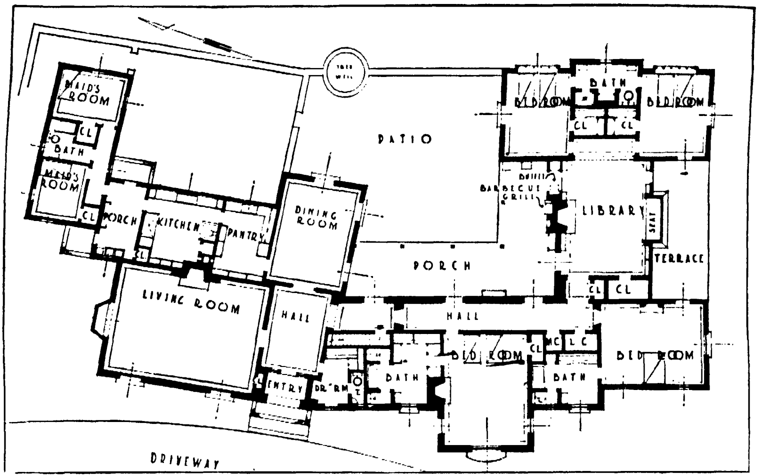
FIG. 112.—A beautiful dining room in the Italian style. Every detail is in character.



Photograph by the Maynard Workshop, Waban, Mass.
Royal Barry Wills, Architect.

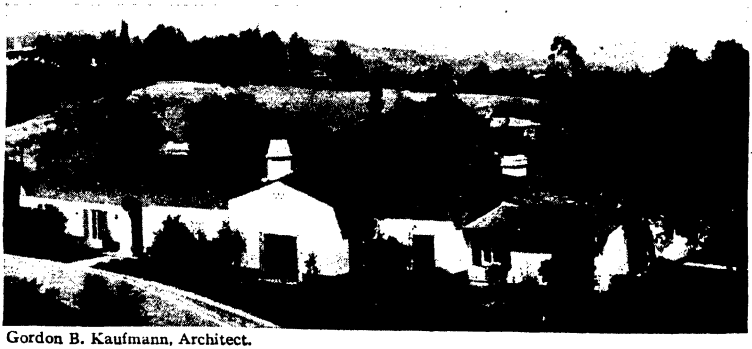
Fig. 113.—A modern home in the style of an early Colonial development.

doors, and, in consequence, we now have cheerful, lovely outdoor living rooms furnished with sturdy, comfortable furniture. These outdoor living rooms may have floors and roofs, and glazed walls,



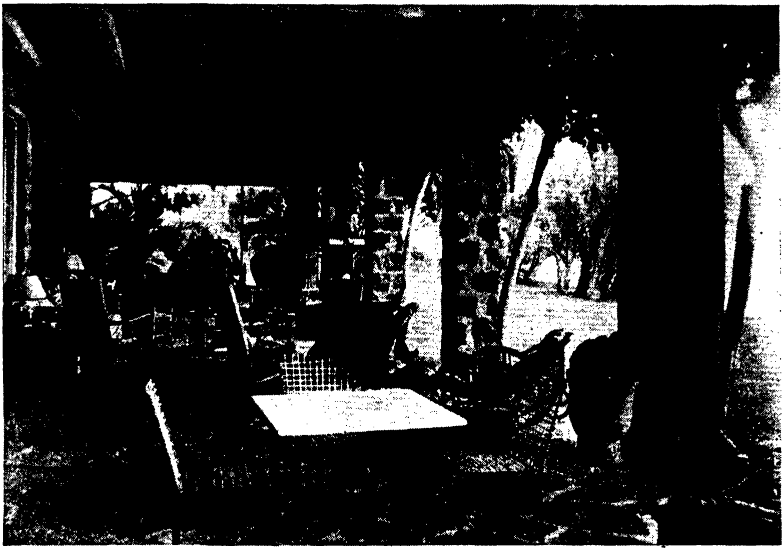
Gordon B. Kaufmann, Architect.

FIG. 114.—Plan of a California house built to conform to the contours of the site, the direction of the prevailing breezes (from the southwest) and the sun's path.



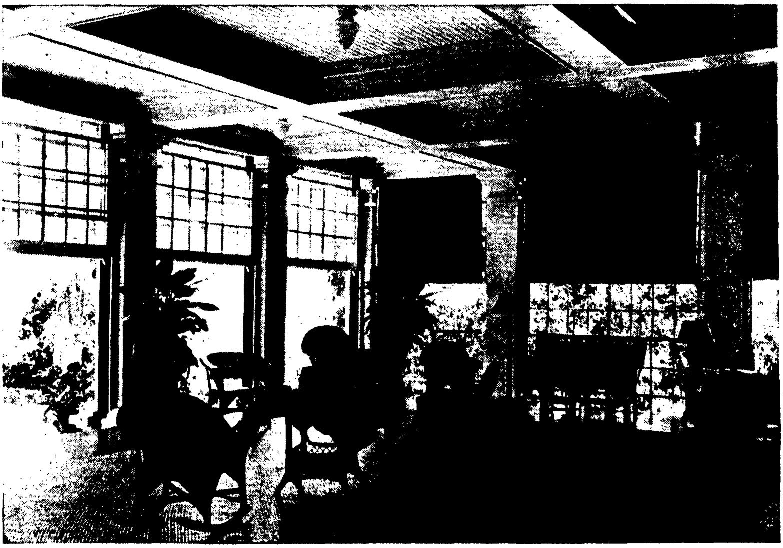
Gordon B. Kaufmann, Architect.

FIG. 115.—View of the house shown in plan in Fig. 114.



Photograph by Warren.

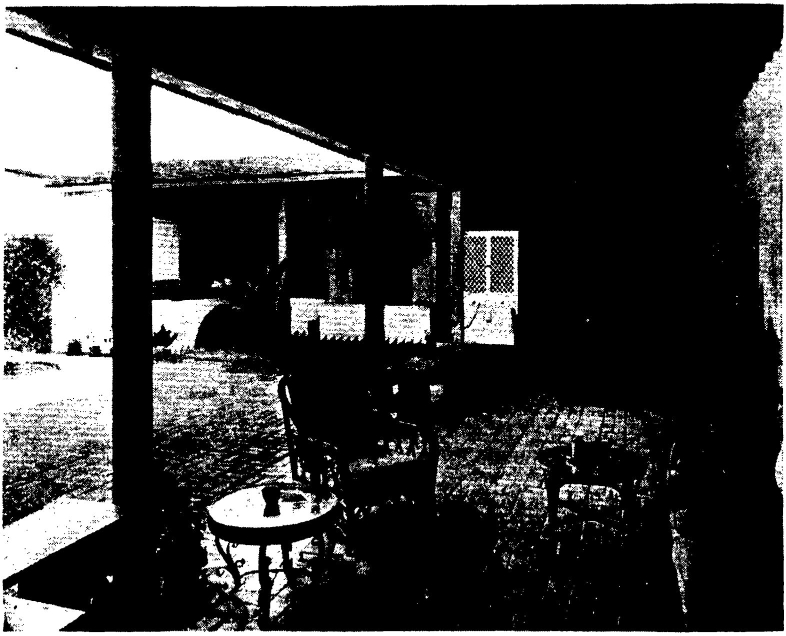
Fig. 116.—The *lanai* of a residence in Hawaii. The ocean is to the right. The paving is of lava blocks, and woven cocoanut fronds form the ceiling.



Photograph by Warren.

Fig. 117.—The *lanai* of Washington Place, Honolulu, the official residence of the Governor of the Territory of Hawaii.

perhaps for winter use, or they may be merely paved, and open to the sky. We find these rooms in cold climates as well as in warm ones for there is always part of the year when such a room is desirable (Fig. 47). In Figs. 116 and 117 are shown *lanais* from Hawaii, for this is the name given there to the porch. The high ceiling, illustrated in Fig. 117 from a house built in 1846 when high ceilings, descended from the Georgian period, were the rule in large houses, is desirable in warm climates for it permits better circulation of air and consequently cooler, fresher air than in a room with a low ceiling. The patio shown in Fig. 118 is in the house illustrated in plan in Fig. 114. Here the patio proper is flanked by a wide grilling.

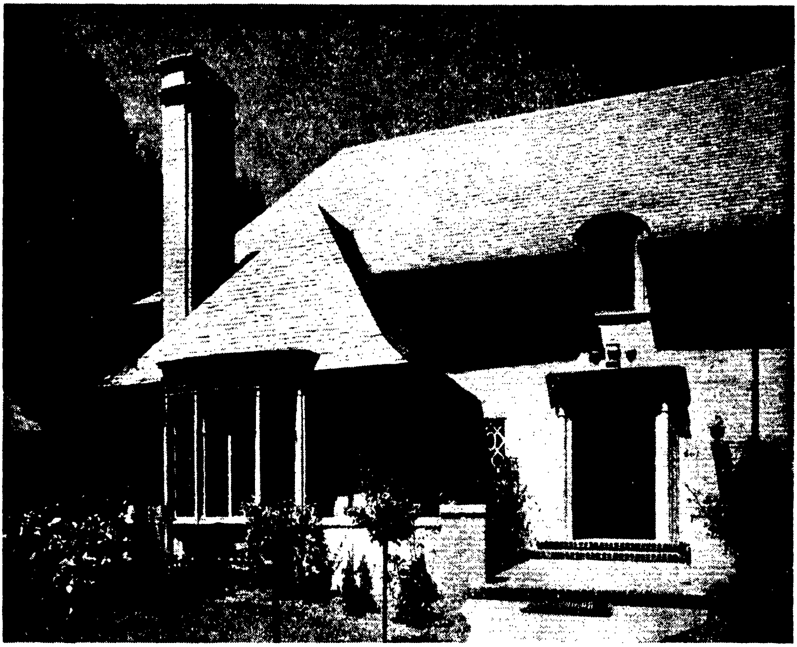


Gordon B. Kaufmann, Architect.

FIG. 118.—Patio of the house shown in Figs. 114 and 115.

Almost everywhere may be found delightful houses in one or another of the traditional manners. In Figs. 119 and 120 we see the French influence, and in Figs. 110 and 121, the English. Two charming interiors are shown in Figs. 112 and 122.

It is easier to find examples of architecture in large houses than in small ones, for an architect of talent and good training is more likely to be employed for the former than for the latter; still, we find some well-designed small houses. One such is shown in Fig. 123. Others may be seen in Figs. 36, 38, and 53. None of these can be described as being in any particular architectural style but they all have good proportions and are interesting in appearance.

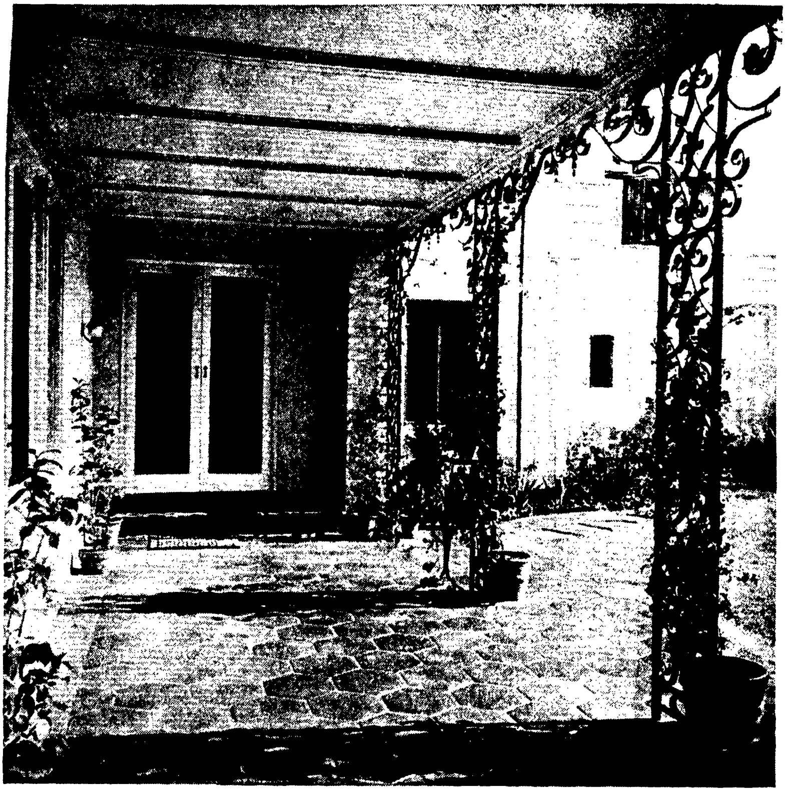


Paul R. Williams, Architect.

FIG. 119.—A modern house the style of which is derived from the French Renaissance.

In Figs. 124 and 125, the plan and a view of a simple but beautiful little place are given. This house is most conveniently arranged, and the excellent proportions of the exterior exemplify the fact that a small house need not lack beauty simply because it is small. Many small houses do, however, and large ones also, because they are not designed by an artist.

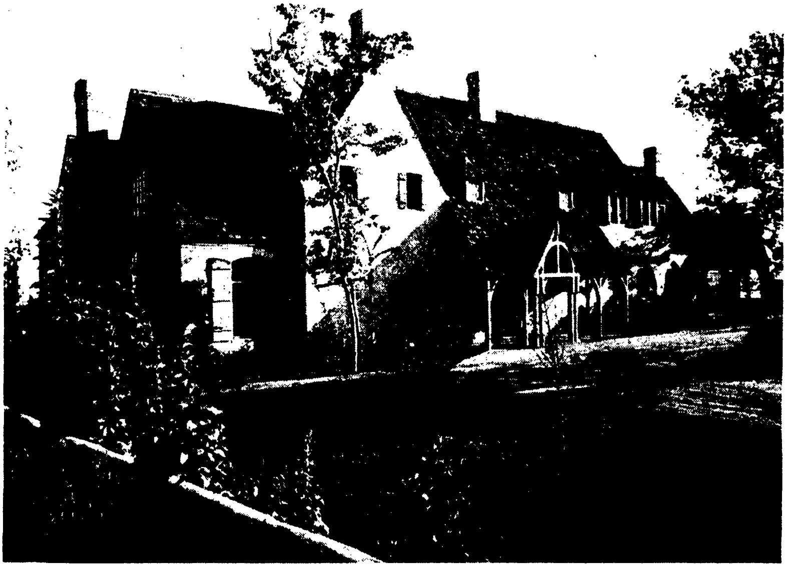
Buildings That Are Not Examples of Architecture.—While the homes of the people reflect our insistence upon comfort, much of the building of the nineteenth century and of the present one does not merit the appellation "architecture" when judged by the rules discussed in the last chapter. Elements from the various styles of architecture are poorly imitated and thrown together without regard to the suitability of the materials used or



Paul R. Williams, Architect.

FIG. 120.—A captivating portico and court showing French influence.

to harmony in the whole structure. New materials have been invented, but instead of accepting them as new goods to be employed in appropriate ways as the artist uses them they are molded into accustomed forms by the business man looking for a market, and we find synthetic roofing coming in sheets blocked off and colored to make a poor imitation of a slate roof, galvanized iron stamped to resemble a carved wooden cornice, and linoleum on which is printed a portrait of an oriental rug, or which is grooved to imitate the dirt-collecting crevices between tiles.



Gerard R. Colcord, Architect.

FIG. 121.—A beautiful house in the English style.

The Speculative Builders Houses.—Many of our domestic buildings have been put up by real estate developers, by builders and contractors, without benefit of architecture, for the purpose of making a profit. They have been built to sell, and the emphasis has been placed on novelty and showy items rather than on those of greater importance. Builders are apt to seize upon some good feature in a well-designed house and force it into their own structures, distorting and degrading it by its lack of relation to

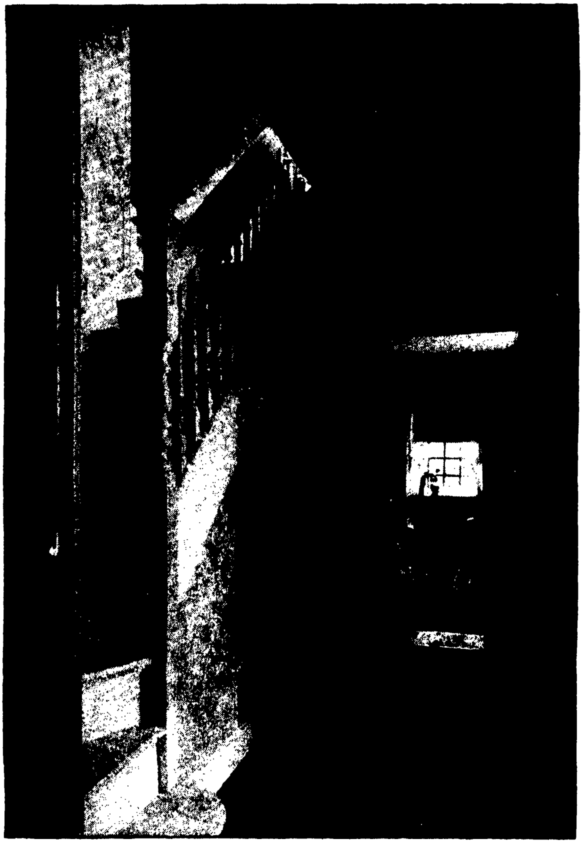


FIG. 122.—An interesting stairway in a tiny hall with a vista.

the whole, by overemphasis, and by coarsening fine proportions and details. Most speculative buildings are travesties of good ones. They are hodge-podges of unrelated features crudely copied and debased and built of sham materials. So we frequently find houses dubbed "Spanish" by the ignorant because of their machine-made tile roofs with living rooms decorated in a mockery of the French manner and with pseudo-Georgian mantels and lighting fixtures, or other incongruous and tasteless combinations of styles.

The plans of such houses are frequently poor. As the size increases doors are less likely to interfere with each other and there are more appropriate spaces for the necessary furnishings, because the walls are longer, but the improvements in arrangement are as a rule fortuitous as is evidenced by waste space in poorly designed passage-ways, dark and superfluous closets, and badly arranged work-rooms.

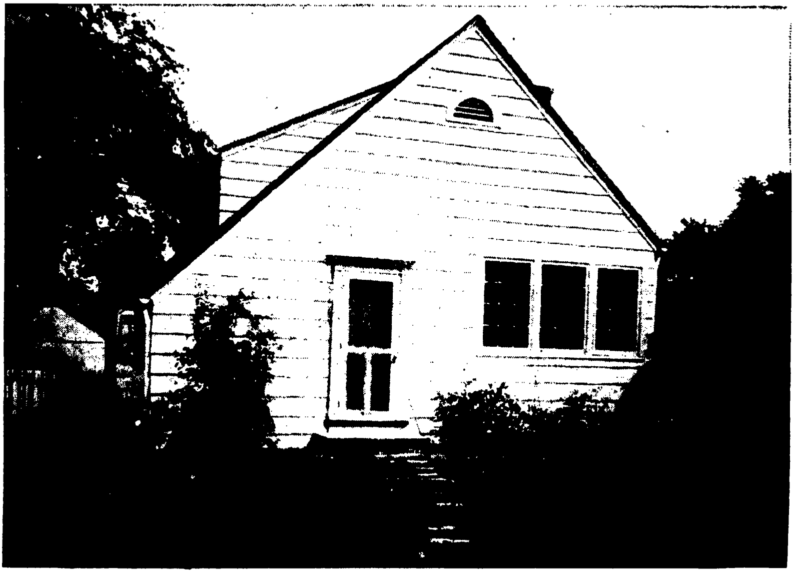
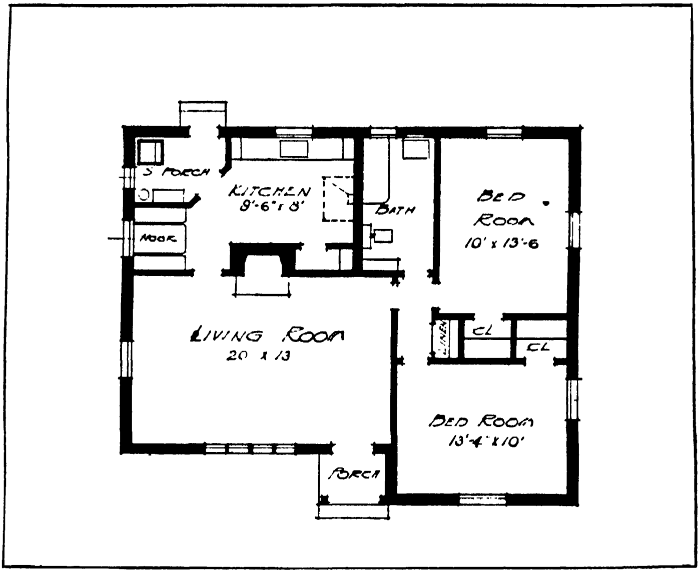


FIG. 123.—Another small house pleasing in design.

In the more expensive houses every latest convenience appears from the dishwashing sink to the heated towel rack, but as a rule placed without regard to its proper location. A burnt match receptacle is set into the wall opposite the one against which the range is set (which may be an electric one). A milk receiver is placed so any one may reach through from the outside and open the entry door.

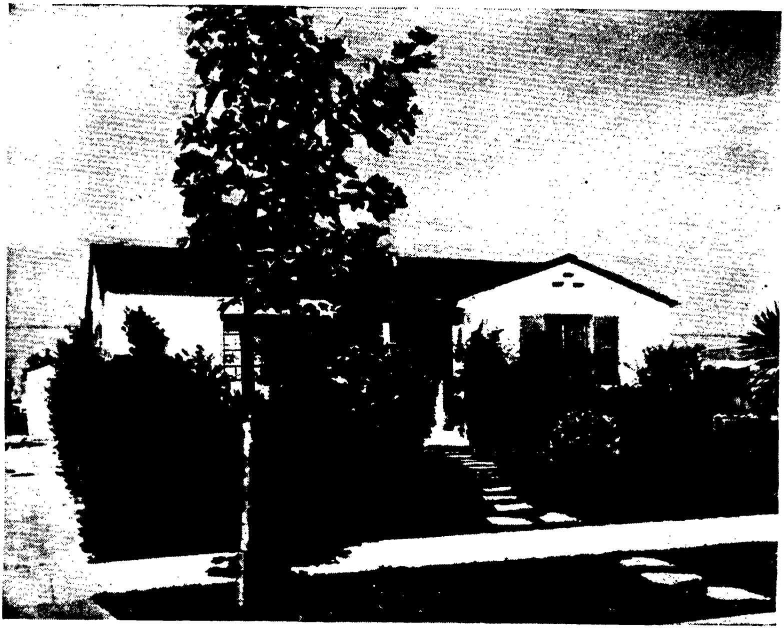
Fashion in Houses.—While fashion in such perishable articles as head-gear, coats, and dresses may be stimulating, add variety to the days, and be of significance in the expression of passing moods without undue cost, it is impossible for any but the wealthy to follow the changing fashions in furnishings and houses. Despite this fact the small house is usually built in the fashion of the moment, and the builder depends on its novelty to catch the eye and fix the choice of the home-seeker.



Gordon B. Kaufmann, Architect. • FLOOR • PLAN •

FIG. 124.—A carefully planned small house. The kitchen and hallway arrangements and the provision of closets are especially good.

Manufacturers and department stores offer us the fleeting fashions in mill work, lighting fixtures, and furniture and floor coverings and thus we are frequently led astray and base our choice on the mode rather than on service and beauty. These temporarily modish features in a house hasten its obsolescence. Anyone who has observed building over a number of years is able to tell in most cases during which decade a given small but pretentious house has been built, either by some peculiarity of plan or elevation or by some interior feature such as the doors, mantel, stairway, plaster finish, or lighting fixtures, although the latter may be changed every few years in attempts to "modernize" the house. Changing one fashion for another helps the producer but the satisfaction gained by the consumer is short-lived and, in the case of things otherwise durable, it is costly. Anyone who possesses a really beautiful and comfortable house either old or new will not wish to change it.



Gordon B. Kaufmann, Architect.

FIG. 125.—View of the house shown in plan in Fig. 124.

Explanation of Disregard for Architecture.—Possibly much of our bad building is due indirectly to the extremely rapid rate of progress in mechanical invention and to the rapid rise in the level of living of the major portion of the population which have occurred during the past fifty to one hundred years. Probably beauty has been forgotten because of the emphasis on the acquisition of material goods, and the public has for this reason accepted what the speculative builder has offered. There has perhaps not been time for even the more highly cultivated portions of the population to assimilate all the new ideas, goods, and services

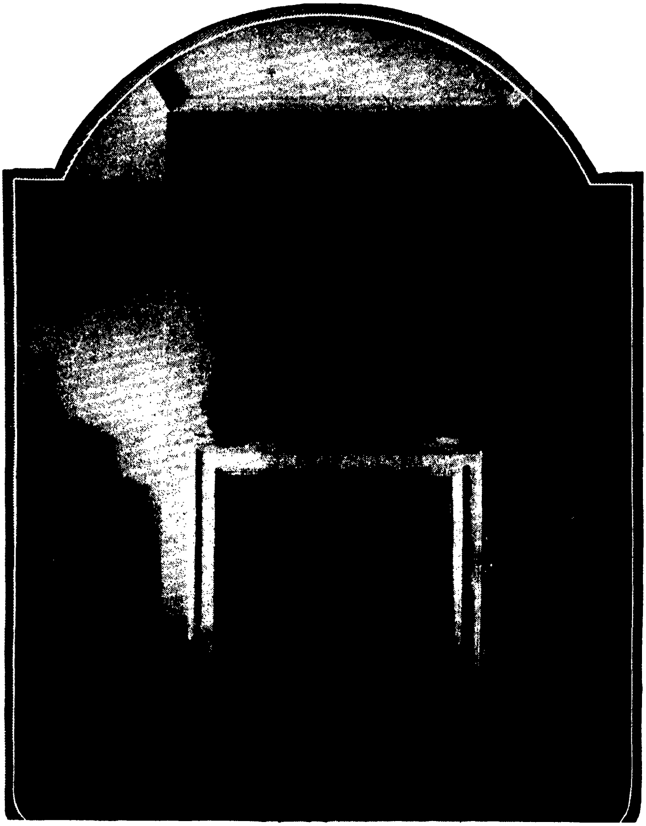


FIG. 126.—An interior of character.

made available in this mechanical age. Wider travel, photography, and rapid communication, by increasing acquaintance with other lands and ways of life, also have contributed to the total of new tangible and intangible things which have come into our lives. Again the democratic ideals which have been the lodestones of recent civilization have led the newly rich to seek to reproduce the dwellings of the nobility of other lands as badges of their own superior status, and have led to imitations on the lower economic levels of the external appurtenances of the wealthy.

Design of the Small House.—In order that the small house may be continuously satisfactory, it is extremely important that it is the best that can be secured with the money available. The structure must be adequate to meet the conditions imposed by the locality. Waste space and ostentatious or superfluous features must be eliminated. It must be conveniently arranged for ease in doing the work and for comfortable living, and it must obey the laws of architecture. Simplicity should rule in the plans and in the elevations. It is well to group the windows in order to gain continuous wall space and to avoid excessive cross lights. Lines and surfaces should not be broken by jogs, scattered openings, or the use of several materials. It is a mistake to try to force any particular style on such a house to the detriment of convenient arrangements. By working out a good plan and allowing the elevations to develop from this while applying the art principles of rhythm, balance, and harmony to the masses and surfaces involved, a good design will be obtained which will yield lasting pleasure (Fig. 126 and Figs. 122, 123, and 125).

PROBLEMS

1. Look for houses in which you can distinguish the influence of some historic style of architecture.
2. Find houses which are examples of architecture and others which are not. Why do the latter appeal to some people?
3. Do you know of any fireplaces in comparatively new houses which are used only once or twice a year, or even less? Why do people have them? Might better use be made of the money they cost?

*4. Look for exteriors which would be satisfactory for your plans.

*5. Draw the elevations for your house plans. You may wish to modify the plans as to the positions of windows, doors, and chimney in order to gain a pleasing exterior. Study such changes to be sure the convenience of the plan is not lessened.

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* The starred problems are those of a connected set running through the book.

CHAPTER XIII

MODERN DOMESTIC ARCHITECTURE

PART II

CONTEMPORARY DEVELOPMENT OF THE UNCONVENTIONAL HOUSE

Science has revealed many requirements for safe and wholesome physical life and mental growth, some of which are related to housing. The opportunities for meeting these requirements offered by recent technical developments are discussed in the following article written for this book by Richard J. Neutra, A. I. A., American Delegate to The International Congresses for New Architecture, an internationally known architect, and one of the leaders in the new developments in the building not only of houses but of all structures and in community planning as well.

HUMAN HABITATION UNDER NEW CONDITIONS

Modern Architecture Operates within the Tradition of Common Sense

Architecture of this day, even in its most untraditional appearances, is in no way that revolutionary departure from the principles of the past which some relish and others assail. To fulfil with devotion the functional requirements of practical use and of psychological satisfaction has been an underlying ideal of good planners, builders, and consumers of building in nearly all historically recorded periods.

Any deviations from this program occurred mainly by reason of an excessive ambition for pompous representation, where architecture was called on to cater primarily to an inflated impressiveness somewhat out of proportion to the actual function and use of the structure involved. If we exclude the showy palaces of some French kings and of other quasi-unlimited holders of power imitating them, we may contend that in most periods of the past building habitations has been protected by natural economy against the danger of losing itself in merely formal play. In these paragraphs we try to explain how much more profound an issue Architecture is than play with shapes and ornaments.

The average human being from the time of the cave to that of the colonizers of the Atlantic border and the Western American pioneers, has built as functional a home as he could afford and as his materials on hand, his knowledge, and his skill in handling them permitted. To do the best possible is a matter of morality and an excellent example to be followed by ourselves.

New Conditions of Industrialization

Modern industrialization based on the manifold developments of technology in the last two hundred years has brought about a new set of social and economic circumstances together with unprecedented modes of living. It has yielded a host of new building materials, vastly different from the primeval 'dobe dug out of the ground, the natural stone quarried in the near-by rocky hills, or the logs cut in the woods of the neighborhood and dragged to the building premises. We now have materials which are the finished products of long drawn out manufacturing processes and are transported over the entire civilized world by means of far-flung mechanical traffic systems. There are steel sections rolled in Belgium, Pittsburgh, or South Chicago and built into structures at Johannesburg, South Africa, and Shanghai. There are plate glass, linoleum, sheet steel, hydraulic cement, diatom powder, bakelite, pressed wood, asbestos board, expanded metal, and, without exaggeration, a million other ingredients which make up the complicated material specifications of each little structure; whereas formerly colossal Greek temples in ancient Sicily were built out of one single stuff, limestone, which served as flooring, roofing, bearing wall, insulation and plastering material. There are now numerous other elements which enter into the building and equipment of any modest home; among them intricate heating, lighting, plumbing, and work-saving devices, from milk delivery receptacles to electric dishwashers and gas-fired incinerators.

Inconsistency of Historical Imitation

Considering all these new conditions and methods in the consumption and production of the home it would seem nothing short of a miracle if the current house were to have an appearance very similar to that of the house built before all the mentioned changes had come about. But this miracle has happened right before our eyes. We see American white collar workers and mechanics living in little buildings which subtly portray the primitive home of a Mediterranean fisherman, except that they are endowed with garages for the new stream-line model cars and that strange radio music sounds through the roller screens of the opened steel sash manufactured in Detroit or Youngstown. The explanation of this puzzling situation is that all the fragments of progressive technology have not yet been integrated into one consistent and unified whole; that no comprehensive moral lesson has been drawn from the present-day possibilities and requirements; that no concrete pattern of home-building has manifested and adequately adjusted itself to the new existing status of civilization.

It is not old tradition or habit which stands in the way of such an accomplishment which in their way all civilizations of the past have achieved. For instance, the Middle Western family that lives "Spanish" in Los Angeles is in no way urged to do so by its ancestral background.

The New Integration Needed

The simple fact is, that it takes a new generation of architects, not merely trained in colleges and libraries of Archeology but cordially appreciative of present conditions, to achieve the desired integration, to coördinate rationally the thousand new details and elements and to digest the complex problem of today's house into a new formal solution. It takes also a new generation of men representing the numerous building trades joining skilled hands in the shop and on the premises under the careful and experienced leadership of that coördinator who is commonly called the architect.

Impatience must be set aside. The process of integration is a slow one and has little to do with the fashions of so-called modernism. All true and great building styles expressive for and of a certain stage of human existence have thus been products of developments coördinated by hard work. The speedy paper decisions of the snappy designers' pencil count for little in the workings of our intricate apparatus of technological, economic, and social progress.

The home, probably more than all other building accomplishments, is predestined to become a most characteristic expression of the coming years, which many of us will probably live to experience and which certainly will set the physical stage for the work and the life of our children.

The Home Influences the Mind of Its Inhabitants

If a home is primarily a place to rear children, it is at once evident what a significant factor it presents in conditioning the young and in the formation of their behavior. Next to the diet our mothers feed us and the thoughts they convey to us in the mother tongue, it is the physical or, in other words, the architectural environment of our nurseries which imprints itself most forcibly on our early physical and mental habits. The nurseries where we play in our first years of life; the bathrooms in which we are taught the habits of cleanliness; the dwellings of which these rooms are a part, with dark corners or light friendliness, with stuffiness or airiness; the garden lots, backyards, or streets where these dwellings are situated; the communities to which these streets belong—all this has power to mold countless lives in their plastic stages.

A Home Is Inhabited by at Least Two Generations

If not replaced by institutions for collective living the future home must be again at least a two-generation home suitable not only for adults, but designed with care to fit the scale and requirements of children, who are just as rightful and perhaps more significant inhabitants, although contributing nothing to the funds for the erection of the house. A design for adult comfort and social prestige only brings with it a sad revenge, for the neglected adolescents break away from this home without repentance; they do not gravitate to it; they do not cherish its memory in later life. It is a wave of thoughtless home design which has endangered and frequently undermined the family institution. Unless we endeavor to house the family group in an adequate shell, it must perish under the strain of centrifugal forces and lack of gravitation around a focus of group comfort.

This writer from his practical experience as an architect can testify that in a thoughtfully designed, truly contemporary home in good relation to the out of doors, not infested with a dead load of historical decoration and a great lot of taboos and "don'ts," children and adolescents have no tendency to desert the family group. On the contrary, such a house with its open simplicity and its play facilities attracts many more little friends than the family boasts children. Here child's play is not an inconvenience to the grown-ups and a permanent threat to the period furniture but a natural habitational function with a full right of performance.

Basic Principles

For every truly contemporary house, urban, semi-rural or in the farmland, large or small, built either under the pressure of economy or with some indulgence to luxurious demands, certain basic principles can be accepted. These basic principles may be briefly summed up as follows:

(1) Controlled indoor climate without losing the intimate relation to the outdoors.

(2) Technologically supported livability even in restricted space.
(3) Dwelling hygiene of an unprecedented character.
(4) Intimacy between indoors and outdoors by which the garden becomes a part of the dwelling area proper.
(5) Æsthetic satisfaction, as in nature, based on a formal and essential integration of all living functions and independent of superimposed decoration.

Controlled Climate

Affirmed and friendly relation to the outdoors expresses the habits of a recent generation, closer to nature than their fathers. We have devices to control the indoor climate, we are less afraid of the hostile elements, we have not like pioneers to contend with the aggression of wild beasts. Against burglars we carry insurance, as there is no door-lock or window-guard effective in withstanding their up-to-date technological methods.

A habitation differs from a shelter and from a mere place of protection, if it grows to be a place of home activity. When the first warming and illuminating fire was kindled in a cave, the human beings sitting around it saw each other relieved from a-social darkness; they started their first contemplative conversations while waiting for friendlier weather to return. Formerly their language had been syllables shouted through the wind from rock to rock and from tree to tree branch. The open air is not good for developing well-regulated speech or sharp intellectual exercise. Standing on the deck of a seafaring vessel one finds it much harder to perform mathematical operations than in a controlled room climate without excessive air movement or temperature attack on one's skin. Many crafts and arts would never have developed outdoors. They were dependent on the cave shelter becoming an indoor habitation. The elaborate and amazing paintings on the walls of prehistoric caves and the remainders of household tools found there, testify not only to an incipient use of the time spent under shelter but to the interesting relation between make-up of mental activity and the indoor climate, which leads to articulation of thought and its precise recording.

The greatest difference between ancient caves and modern dwellings is due to the fact that we are incomparably better equipped than our ancestors to control, and *subtly* control, room climate, as to radiation received, moisture content, temperature, movement, purification, and gentle restoration of the air volume without losing the intimate psychological relation to the outside spaces. We owe this among other things to the exquisite and increasingly economical production of a variety of window glass answering specific biological requirements.

There are actinic, heat-reflecting, ultraviolet-ray, and diffusing glasses. A host of translucent glasses of special service properties and even glass masonry have been widely used in Continental house building. The writer himself had useful results from devising an exact replica of daylight illumination on outside window overhangs with influx through the window glass into the interior (Fig. 79).

In brief we can state that present technology leads back to natural outdoor conditions while maintaining the advantages of a controlled climate. The progressive home interior resembles less and less the cave to which we may still feel linked by the subconscious racial memories of the species.

Comfort and Space

Modern comfort and economy of space are combinable. Even a luxurious motor car is a plenty in a nutshell! We cannot model our homes after the architectural patterns of the past where comfort was produced by a host of servants or slaves, requiring space and again space. Second class staterooms of elaborate ocean liners, air ships, and the newest Pullman compartments with all their built-in captivating handy gadgets are more likely to serve as models for future dwellings than the huge palaces of the Emperor Diocletian in ancient Dalmatia and Syria or the sun kings in France, which devoured gigantic quantities of human service to produce for a few a moderate sum of livability. Modern comfort is not dependent on social injustice as it was so often in the past.

The International Congresses for New Architecture[1] by their research work in twenty-three countries have endeavoured to show how much convenience and satisfaction even the minimum size dwelling of 350 or 450 square feet floor area can offer.

What is true for the whole dwelling is true for each of its rooms. The small step-saving kitchen becomes, when carefully laid out, the ideal of the servantless housewife (Fig. 29). The bedroom used only for eight night hours is, with the installation of a day and night couch and a little built-in desk, transmuted into a small permanently useful private study into which the individual can withdraw on occasions from the life of the family group, to read a book, write a letter, or follow some personal hobby. The living room proper will remain the largest division of the home but even here built-in furniture, suitable shelving, collapsible tables, and a well-studied relation of living and traffic areas will help much to lend a physically restricted room at least psychological spaciousness.

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[1] *Les congrès internationaux d'architecture moderne*, principal offices, Zurich, Switzerland.

Garden and House

Garden spaces around the dwelling must not only be decorative but must be true living areas. The traditional Japanese house shows by example that even a tiny backyard can be made to bring much of the refreshment and charm of nature close to even the urban human. Intensive design goes before extensive design. Space economy can be a stimulus rather than an impediment.

Household Cleanliness

The modern home is not serviced by slaves and rarely by servants. But this should not mean that the inhabitants themselves and the housewife in particular must slave to keep everything going and in convenient order. Cleanliness without toil is quite a novel situation. And the novelty of it is intensified by a change in the conception of cleanliness. The Mohammedans of Southern Asia have a ritual conception of cleanliness which is to be found in the earlier Western world also, in many incidents. The symbolic gesture of washing rather than the results of it used to satisfy. The Japanese have a meticulous conception of, and an old established tradition for, what may be called visual cleanliness. Dirt must not show and if it does not show even to sharply searching myopic eyes, all is well. This conception also has its parallel in occidental habits. However, with the popularization of microbiotic studies, the more primitive conceptions of cleanliness have been augmented and sometimes supplanted by the realistic and, in its core at least, scientific one of household hygiene.

Guided by this new concept modern architects in Japan have found under the spotlessly clean traditional floor mats on which even the meal trays are served and on which the inhabitants recline for their night's rest, dirt of several months. The customary wooden tub in the old Japanese house was judged inferior to the imperviously surfaced tub from the stock of the American importer; old established smells about the house were suddenly discovered and a battle put up to eliminate their threatening causes. Anything which is in its form too intricate to be kept clean, like the Japanese woman's hairdress which must last for a week and internally is filled with the dust of a week—was doomed. Easily cleaned surfaces with a minimum of joints; finishes hard to permeate by liquids and gases; elimination of dust catchers; clear visibility of dirt wherever it may collect, good daylight influx into all nooks and corners to enable the eye to direct dirt removal by means of the various new and effective cleaning tools—these are fundamental to present day household cleanliness and are becoming increasingly significant also for the psychological satisfaction of the new generation of inhabitants. Coziness by uncontrollable dimness, inaccessibility of voids and hollows left in the cramped set-up of furniture, fixed draping of windows to "dignified darkness," high pile upholstery goods and carpets become questionable, if not obnoxious. Plastic ornamentation is being replaced by smooth, cleanable, durable surfaces with color appeal and attractive finish. Enamelling, glazing, plating, anodic oxydation treatment, bakelite, rubber, linoleum, steam-pressed fiber composition, opaque glass, metals and metal foils gain importance as finishes, with industrialization invading this field.

Æsthetic Satisfaction and the Art of Home Design

Aside from certain instinctive inclinations for simplification by rhythmical repetition and geometrical regularity, which are integrally a part of our mental make-up, we all conceive as æsthetically attractive that to which we have been conditioned and accustomed in our infancy and adolescence. This explains why the formal appearance of the house must be slow in changing pattern.

However we are all used to finding beauty in free nature and consciously or not we feel that in nature, specifically in organic nature, all appearances signify definite functions of life and strike us as beautiful because of this. A fish is beautiful because its shape and even surface texture express its manner of locomotion within its liquid medium. A linden tree has other vital functions than a pine tree, prefers other soil, sub-soil, sun and wind exposure, location, and plant company and therefore looks different. Obviously, in this complete functional adjustment lies the beauty with which a carefully observed plant fascinates us. Beauty and variety here are not additional somethings, decorations superimposed on utilitarian machines. There is no splitting dualism. The American architect and philosopher, H. L. Sullivan, demanded that form follow function also in building. Decoration was a means to cover up the imperfection of man's products. In proportion to the fuller achievement of subtle satisfaction decoration and ornamentation recede. The thing itself becomes beautiful. Under creatively lucid heat it begins to glow in the genuine fusion of its particles into one whole and to ring like a well-cast bell when its integration of form and function is fulfilled.

The conclusion here is that in designing and finishing a habitation we must not be in a frenzy of hunting after non-essential decorative schemes. We must trust that a sincere design loyal to well-conceived practical and psychological requirements will never tire the inhabitants and will leave stimulating space for their own individual and casual expression.

New Architectural Developments.—Toward the end of the last century, we find the beginnings of a revolt against the domination of architectural tradition and the perpetuation of the older types of building. New ideas first appeared in business buildings with the advent of the skyscraper, not only in its height and the use of steel but also, as time went on, in its design which frankly proclaims the new type of structural materials and the adaptation to new methods of business.

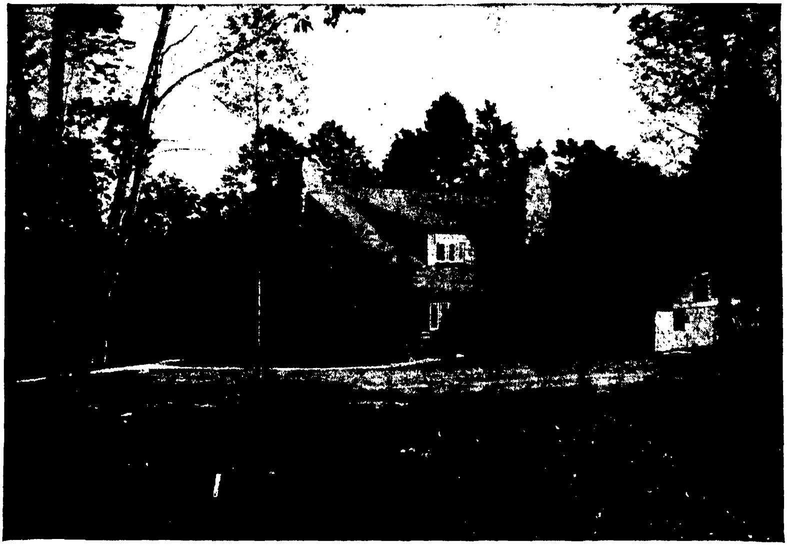
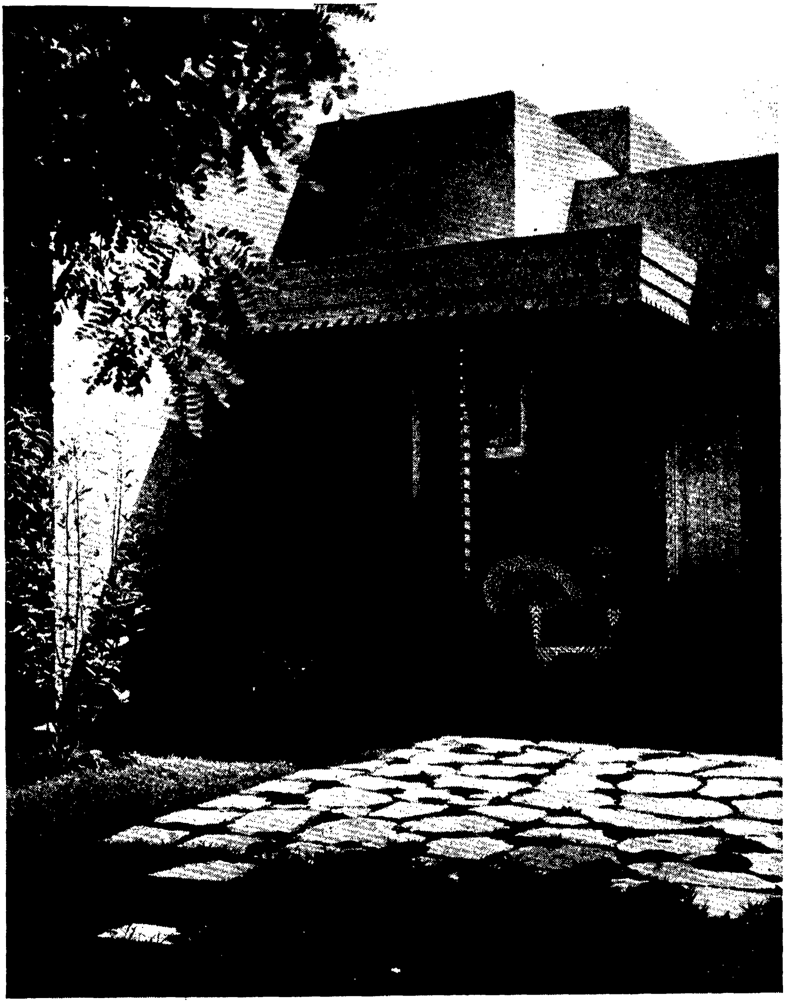


FIG. 127.—A "Craftsman" house, the home of Gustave Stickley. The house fits its site, it is built of local materials, the design is straightforward, and there is nothing in the way of applied ornament.

When steel was first used the architect trained in the Classic tradition designed a building and then called in the engineer to execute it. Design and structure were divorced. In modern developments, we find the engineer the designer, or the architect the engineer. Structure and design are again wedded as in Classic and Gothic architecture, and it is to this fact, together with the recognition of the importance of planning for convenient, comfortable, and wholesome living, that we owe the new style which is manifest in factory, office, and merchandising buildings.

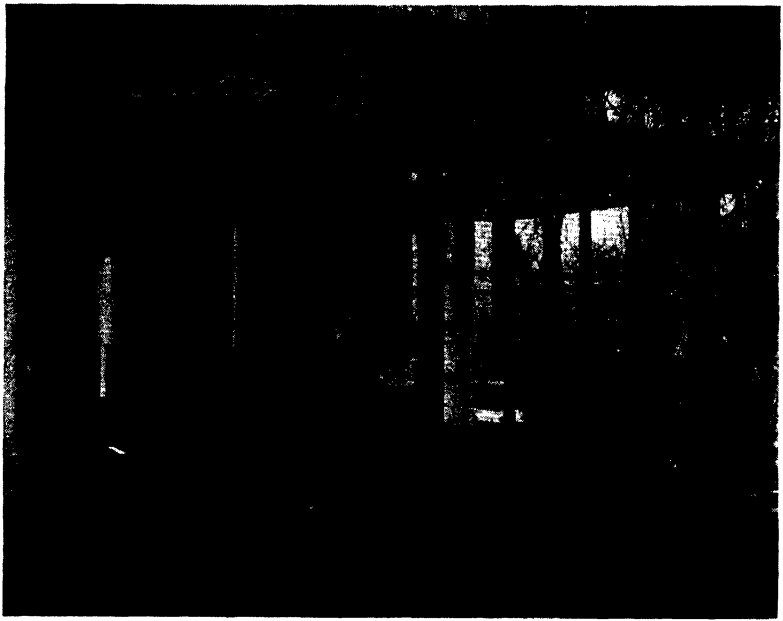
Residence building, however, has continued on more conservative lines despite the influence of Ruskin and Morris on arts and crafts and the fact that some unconventional houses were built comparatively early (Figs. 127, 35, and 138). There may be



Lloyd Wright, Architect.

FIG. 128.—An unconventional house, by a pupil of Frank Lloyd Wright.

several explanations of this. In so far as the home is regarded as a sacred institution there is a tendency to resist any change in it and to be governed by tradition rather than by progress in both its organization and in the material elements which form its setting. Besides, the home is not a competing institution as is business; for that reason there is less stimulus to experiment and to counteract the inertia of habit. For these reasons the building of homes has tended to remain largely in the hands of contractor-carpenters working according to formulæ and using the older, better-known materials.



R. M. Schindler, Architect.

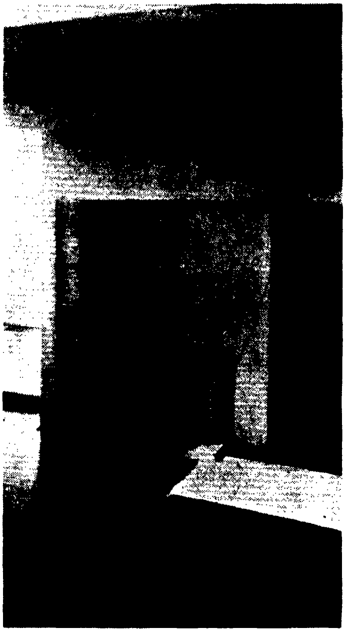
FIG. 129.—Residence of R. M. Schindler, showing the interlocking of the living room with the out of doors. Sliding doors close this room when desired.

The Middle West of earlier years was less bound by legacies from the past because of its comparative isolation and was more given to experiment and makeshift. There were no venerated examples of building from earlier civilizations to form the taste of the pioneers as they emerged from their sod-houses and logcabins into a complicated world, and it is in this section of the country that we find the earliest beginnings of a new architectural movement in the business buildings of Richardson and Sullivan.

Unconventional Domestic Architecture.—Frank Lloyd Wright was the first to achieve distinction in the creation of unconventional houses. Wright's originality and freedom have been expressed in different ways according in some degree to the local conditions of the places where he has worked. Among his earliest innovations were low ceilings, wide eaves, the use of many windows grouped in long rows, and the emphasis of the horizontal line given by these bandings of windows and by the use of contrasting materials to bring out the continuous lines of eaves and sill courses. This type of building originated by Wright is called the Prairie Style (Fig. 35) because he definitely stated his aim was to relate his buildings to their surroundings and to emphasize the beauties of the prairie.

In contrast to this style, we have other expressions of his original genius in steel, brick, poured concrete, and concrete blocks in this and other countries.

Wright has followers who do not copy his manner but interpret the governing principles which underlie it according to their own talents, the materials they have to work with, and the needs to be met (Figs. 128, 129, 130, and 170a). There are also those who copy without appreciation of the basic principles involved and consequently their structures are perverted and merely evidence another fashion.



R. M. Schindler, Architect.

FIG. 130.—Fireplace.

The governing concepts underlying unconventional building are positive and negative. The positive ones are given as rules of architecture in Chapter XI. The negative ones may be stated as follows: Outgrown dreams, ideals, ways of living and techniques must not mold present day buildings. Accustomed forms and precedent must not limit the expression of new dreams, ideals, and ways of living. The fundamental idea is to consider functional requirements first and always, and to accept whatever follows of repetition and of regularity or irregularity; that is, first of all to have a good plan and to develop the elevations from it. (Figs. 124, 125, 133, and 134).

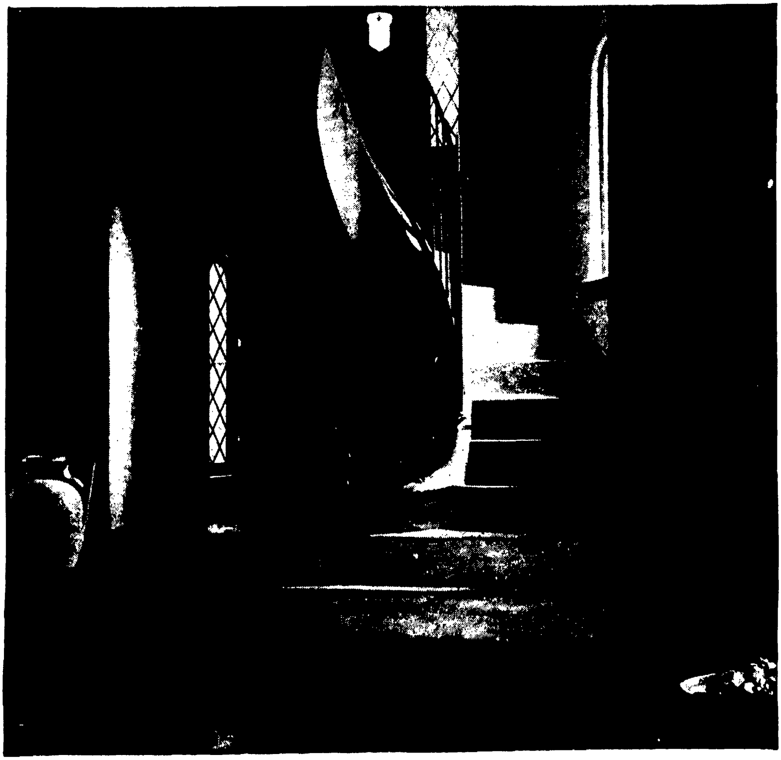
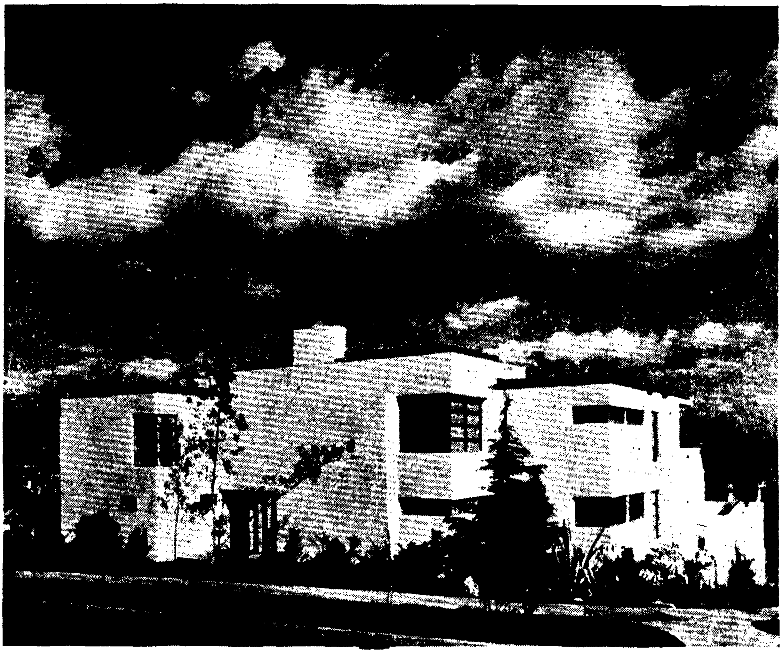


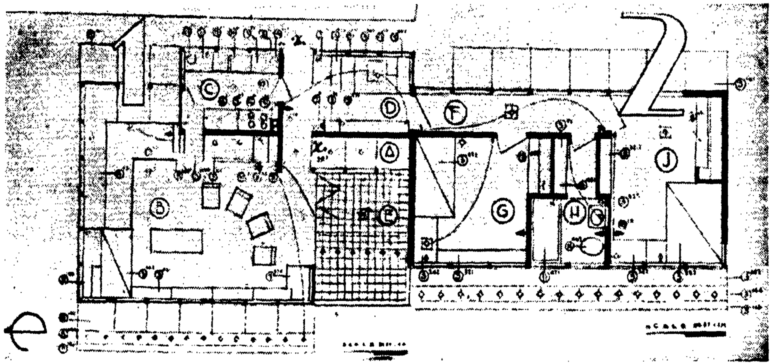
Fig. 131.—A circular stairway.

The International Style.—Among the architects who have thrown off historical formulæ for the expression of the underlying ideals of home dwellers are certain Europeans and Americans who working simultaneously under the stimulus of Wright's work and later of each other's, developed what has been called the International Style on account of the way it evolved and of its rapid spread. It has been said that these architects who have forgotten old forms and think and work in the present do so in terms of volume and space instead of mass and solidity. Due to the fact that supports are concentrated, and not continuous in the walls as in the familiar frame building, their plans have an appearance different from that of the plans of the conventional house. Exterior walls are frequently mere curtains as they were in Gothic cathedrals, and when the frame of the building is of steel or reinforced concrete the plans have a light and airy appearance, the emphasis being on the space enclosed rather than on the wall masses (Figs. 133 and 135).



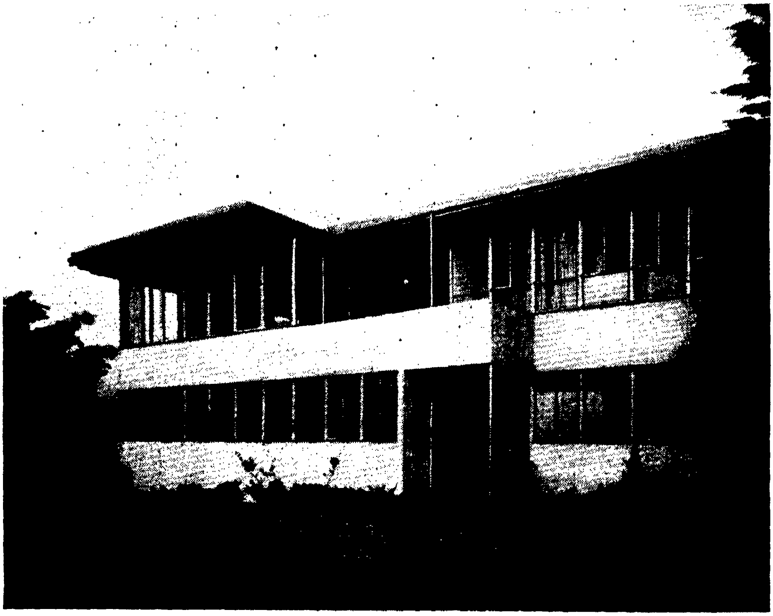
Douglas Honnold, Architect.

FIG. 132.—A modern residence.



Richard J. Neutra, Architect.

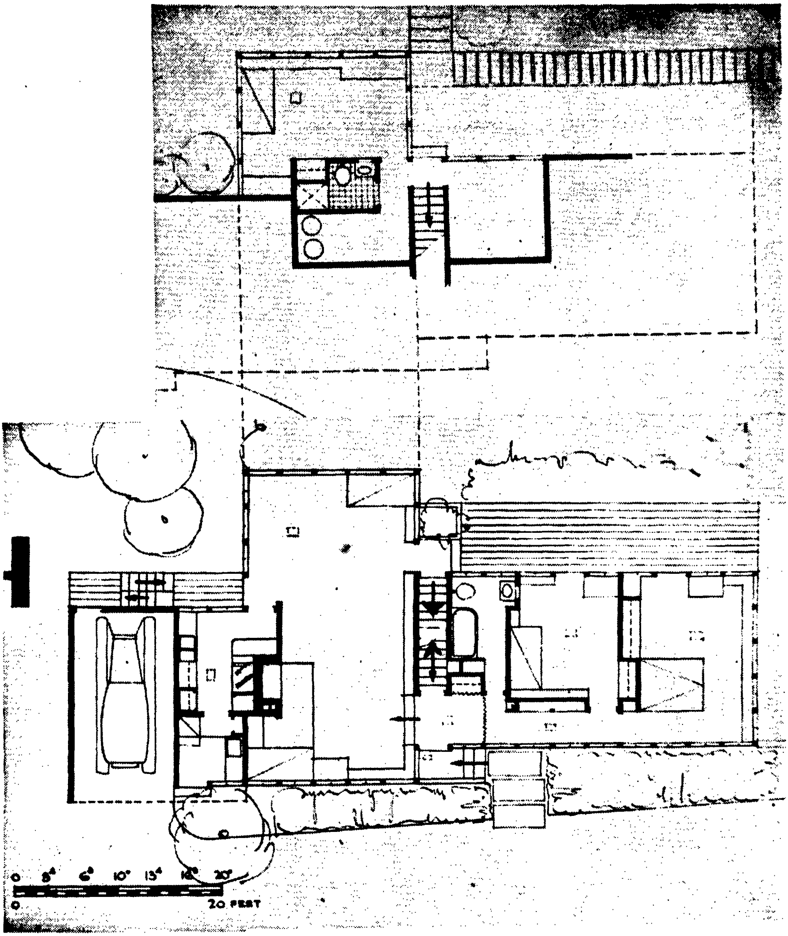
FIG. 133.—Plan of the second floor of the V. D. L. Research House. Stairways from the first floor end at the point marked x. On the first floor are studios. This is a steel-built house; in it many materials, some of which are changed from time to time, are tested under actual living conditions.



Richard J. Neutra, Architect.

FIG. 134.—View of V. D. L. Research House which overlooks Silver Lake, Los Angeles, lfornia. An interior view of the living room of this house is given in Fig. 79.

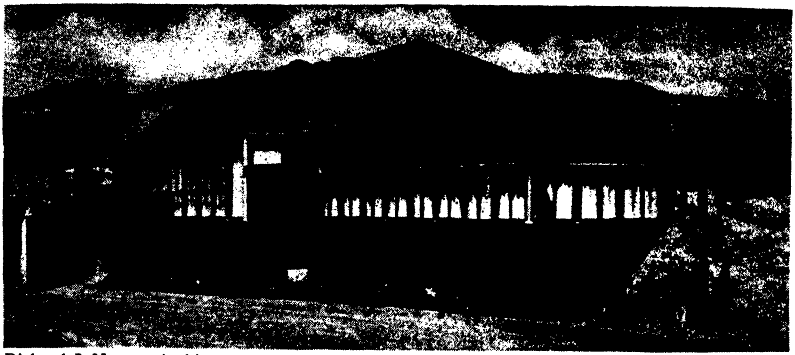
The tendency among the exponents of the new style is to avoid any pattern which does not arise from the disposition of the units



Richard J. Neutra, Architect.

FIG. 135.—Plans of a hillside house. The plan of the roof and the second story rooms is at the top.

of the structure; thus the materials of which the house is built are left in their natural finish or when surfaced the finish is plain, and there is no applied pattern (Figs. 134 and 136). Since these plain surfaces are easily marred, washable ones are chosen so their beauty may be maintained. There is no shamming no matter what materials are used (Fig. 137). The absence of applied ornament leads to the study of the plain masses to make them of pleasing proportions each in itself and all in their relation to each other. Much of the furniture is built-in, simplifying house-work and giving an impression of spaciousness in a comparatively small area. The effect of these houses on the whole is one of quiet, peace, and restfulness.



Richard J. Neutra, Architect.

FIG. 136.—View of house shown in plan in Fig. 135. This house has a standardized wood chassis to fit factory-made steel sash.

In these developments there is no violation of architectural laws discovered in the study of the historical styles. They are indeed closely and subtly related to ancient buildings through obedience to the same fundamental laws, although in a new environment. On the other hand the ponderous and pompous counterfeits of Classic, Gothic, and Renaissance architecture, in which tons of marble and stone are employed to encase a steel structure, or in which the plans make little or no provision for satisfying our needs for sunlight, air, and parking places, or in which all the possibilities offered by copper, aluminum, and the many new lightweight but strong alloys and by the large number of recently developed vitreous compositions are passed over in favor of antique and less satisfactory materials as is so frequently the case in churches and "monumental" public buildings, are false to these rules.

Business and industry have shown the way. Housewives have learned that business methods are applicable to the home, that the home as a production and consumption center is a part of the economic structure, and that efficiency promotes home-making; so doubtless we will see more and more functional, labor-saving, culture-fostering houses and furnishings.

R. M. Schindler, Architect.

FIG. 137.—Roofing material used in a straightforward way; a view of the house shown in plan in Fig. 19.

PROBLEM

* Design the elevations for your house plans, changing the latter if necessary.

* The starred problem is one of a connected set running through the book.

CHAPTER XIV

THE GROUNDS

Dwellers in tenements and apartments must make their homes within the bounds of walls, but those who live in detached houses may extend the home beyond them, out to lawn and garden and orchard. Only those who include a bit of the big outdoors in their premises can have all the material requisites for an ideal home.

Relation Between House and Lot.—Too many builders ignore this feature of the home, erecting great, expensive houses on small lots which afford no possibility of proper treatment. Every house should have grounds surrounding it and they should correspond in extent to the size of the house, for the grounds are the setting of the house. Often a new house has a bare, forbidding appearance when the workmen have left it complete and perfect in every detail, but a lawn and a few well-chosen and properly placed trees and shrubs change the entire effect and give the place an attractive and inviting aspect.

We need to think of this setting constantly, to have it in mind when we choose the lot, when we plan the house and when we decide upon the part of the lot on which the house is to be placed. A fine old tree and wild brush are valuable assets. We should preserve them when they will add to the beauty and comfort of our home. It may be wise to locate the house in such a way that the tree may be undisturbed and the wild shrubbery left where it will produce a good effect (Fig. 138).

Necessity for a Garden Plan.—The grounds must be planned as a whole with one prevailing idea and every detail should conform to the plan for the whole. The haphazard setting out of trees and shrubs and plants, just because they are beautiful in themselves does not make for beautiful grounds. Unless there is a plan for the arrangement of the grounds and unless the materials used are selected with reference to it, the place will lack unity, that is, correlation between the composite parts.

Garden Styles.—There are two chief styles of gardening, the architectural, or the formal, and the natural. Whichever is used, the house and its setting should be in harmony and should express their native regional character. If we build an Italian villa it calls for an Italian garden, a house in the Japanese style may have a tea garden, but if we build our houses according to the principles stated in this book we will have American houses which suit New England or Southern or Middle Western or Coast conditions, and these houses must be placed in appropriate settings.

Landscape gardening is a fine art, but not too fine to be applied to the ground surrounding the most modest cottage. The same principles apply to the fifty-by-one-hundred-foot lot as to the great estate. In either case the surrounding natural landscape must determine the general design. Good design, no matter to what it is applied, must meet the necessities and conditions peculiar to each case.

Courtesy of *Illinois Agricultural Experiment Station.*

FIG. 138.—The owner and architect of this house loved trees so much that he built his house with the porch around three of them, cutting a hole in the eaves to make room for one.

Natural Style.—Architectural or formal gardens are suitable for parks, public buildings, or large private houses, but for the ordinary small house, in most cases, grounds designed in the natural style are more appropriate. This is a style of broad, open lawns, curving lines and grouped trees and shrubs. The lawn should have a gently undulating surface following the natural slope of the land, for this, except in formal grounds, is more pleasing than perfectly flat surfaces; it should not be cut up with walks and drives, and it should not be crowded with trees and flowers (Fig. 139).

Position of House and Approaches.—The house is best located to one side of the lot, and the walk or drive from the street or road

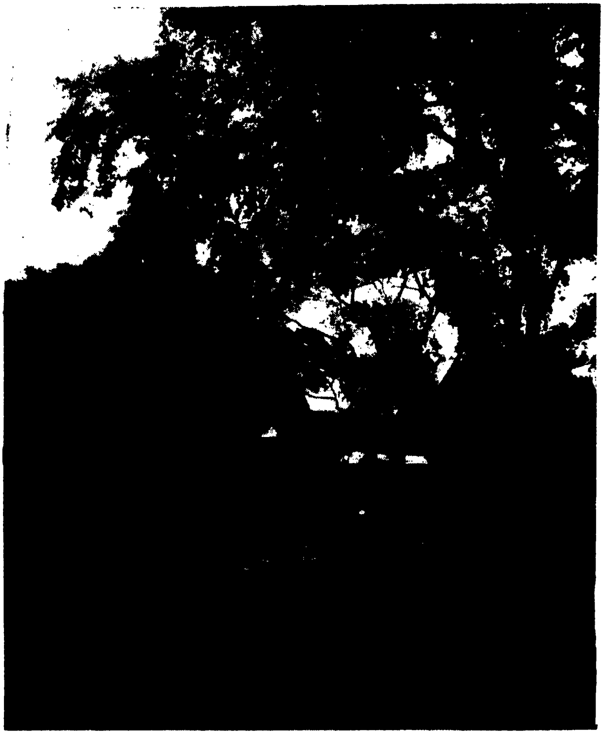


FIG. 139.—The lines and surfaces of an undulating lawn are beautiful.

to the house should be as far to one side as it is possible to place it without inconvenience, in order to gain space for open lawn. Although in general the best road is the shortest, straight lines are not natural, so whenever it is not too great a sacrifice of directness, driveways and walks should curve. The curve should not have an artificial appearance, there should be an obvious reason for each change of direction. A tree or sharply sloping ground, a rock, or a piece of water demands a change in a drive, but a sundial or a flower bed may be placed anywhere and therefore these are not legitimate reasons for curving either walk or driveway. Unless there is a real reason for curving a walk it is best to make it straight rather than to have a meaningless, serpentine effect (Fig. 140).

Shrubbery.—Shrubbery placed close to a building serves to tie it to the ground, to give it a base from which it rises and to soften the line between the artificial lines and surfaces of the house and the natural ones of the ground. Vines clinging to the walls, climbing the columns and cresting the tops of porches have somewhat the same effect (Fig. 141). Shrubbery is useful in other places, to form screens and boundaries, to give masses of color and shade, and, together with neighboring trees, to form pleasing sky lines. The natural style calls for a liberal use of shrubs, for we find them freely distributed in nature. They should be planted in unsymmetrical masses with projections and recesses, and should

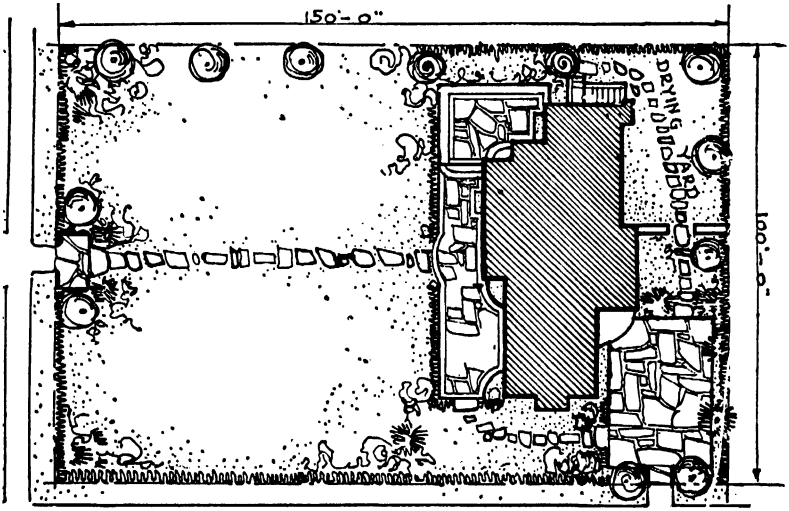


FIG. 140.—The main entrance to the house is through the flagged court in the corner. On the garden front a second door opens upon a paved terrace overlooking the lawn, the continuity of which is scarcely broken by the irregular stepping stones across it.

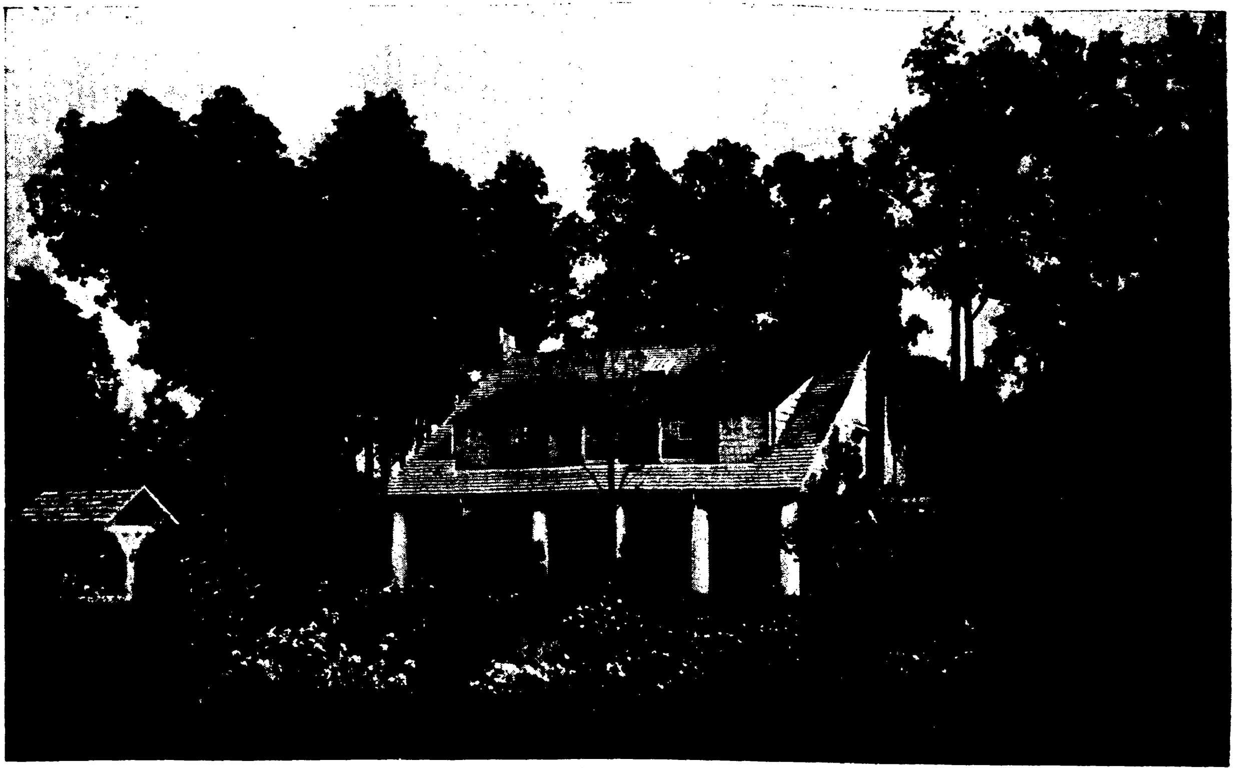


FIG. 141.—Shrubbery and vines tie the house to the ground.

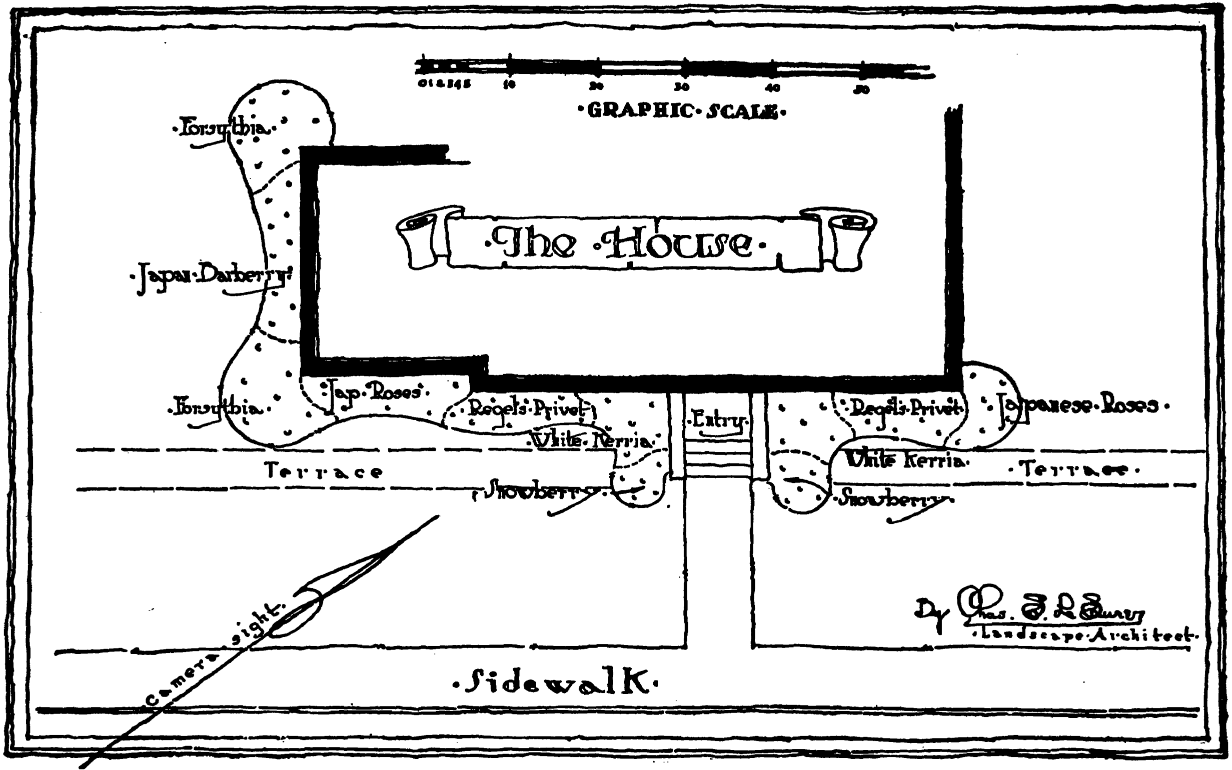
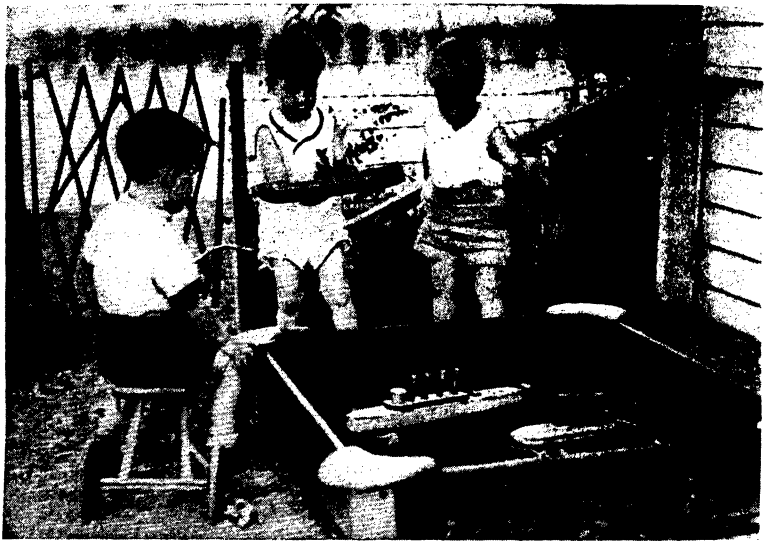


FIG. 142.—Plan for the planting of shrubbery close to the house.

be irregular in height. They should not be set in the fair open spaces of lawn, nor when placed on its border, as they well may be, should they encroach too far upon it (Fig. 142).

Trees.—Trees should be grouped, for this is the way we usually find them in nature. We have to set them in straight rows in our parking, but this is not out of place there because of the contiguity of the artificial straight lines of the roadway and sidewalks. Trees may be so placed as to frame a fine view, to hide a wall or building, to form a background, perhaps merely to give shade. No trees should be set out without a definite purpose and without careful consideration of the grounds as a whole, else we may find a tree interfering with a view or making shade where sunshine is needed. Quick-growing trees are short-lived, and if we plant them to get rapid results we should also plant some of the slow-growing, long-lived ones to insure beauty when the first have become thin and poor, and must be cut out.

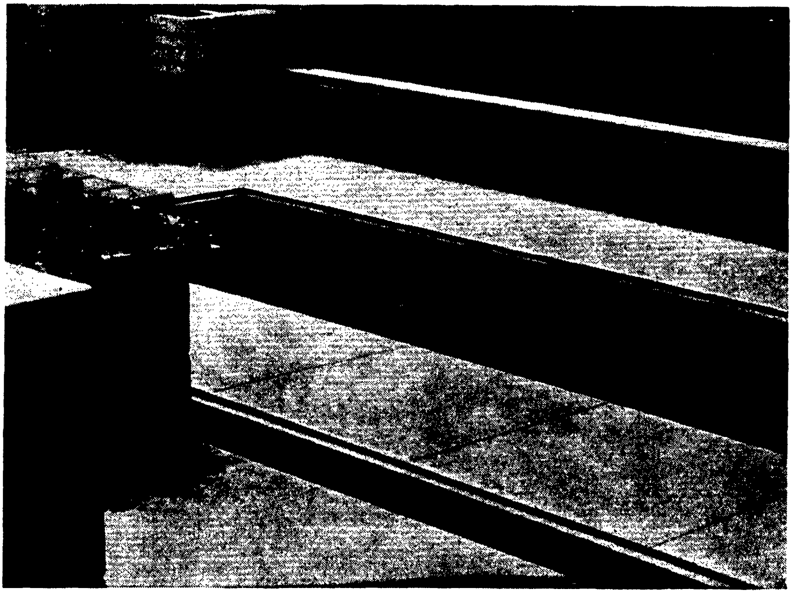


Photograph by Gene W. Ross.

Fig. 143.—The children's own corner.

Play Places for Children.—Before planning for flowers, the children's play must be considered and ample space with sunshine and shade set apart for their special uses (Figs. 143 and 145).

FIG. 144.—A border of properly placed flowers planned for continuous bloom.



R. M. Schindler, Architect.

FIG. 145.—A wading pool for children.

Flowers.—In the natural style, flowers should be grown in irregular, inconspicuous borders along walks, or walls or at the base of shrubbery around the house, but never in beds. Tall plants such as hollyhocks are more fittingly placed against a wall or fence than along the sides of a walk. Flowers which need to be cut or which we like to gather should be placed where they will be accessible (Fig. 144). If the grounds afford enough space, some part of them may be set aside for a formal flower garden which should be screened by a hedge or fence.

Fig. 146.—Bare branches and snow are beautiful.

Choice of Plants.—Native trees, shrubs and plants should be the first choice and should make up the greater part of the plantings. All other plants should be in harmony with these (Fig. 144). There should be a blending of foliage and flowers, and no glaring contrasts of color or texture.

In the selection of plants of all kinds there should be a well-defined plan. Are the grounds to be planned for a glorious display for one month and to be rather uninteresting the rest of the year, or are they to be planned so that from early spring to late fall there will be a succession of sweet blossoms and pleasing color changes? In planning our grounds we need to consider each month in the year. If a family has a home in the country, which is visited for a few weeks at a certain season, it would be a disappointment to find that the plants selected to beautify the place are at their best either before or after the annual visit. A place that is lived in almost all the year round should be attractive all the year round. Even in the depths of winter it may be so, for there is great beauty in bare branches against a wintry sky, and the rich shades of bushes and tree trunks, and the dark hues of evergreens give a wondrous coloring to a white landscape (Fig. 146).

Illinois Agricultural Experiment Station.

FIG. 147.—A rockery characteristic of the natural beauty of the surroundings.

Any natural ledge of rock, or bit of water is worth preservation and study and should be planted with the native rock-loving or water flowers to restore and preserve the characteristic natural beauty of the spot (Fig. 147). The ordinary conventional rockery set in the midst of a flat lawn and planted with Alpine flowers is a monstrosity. Fountains are not suitable to the natural style of landscape gardening, but a little streamlet running through the grounds or a broad river or lake bordering them, adds immensely to the artistic possibilities of a place, but the normal atmosphere of these must be retained if their full value is to be enjoyed.

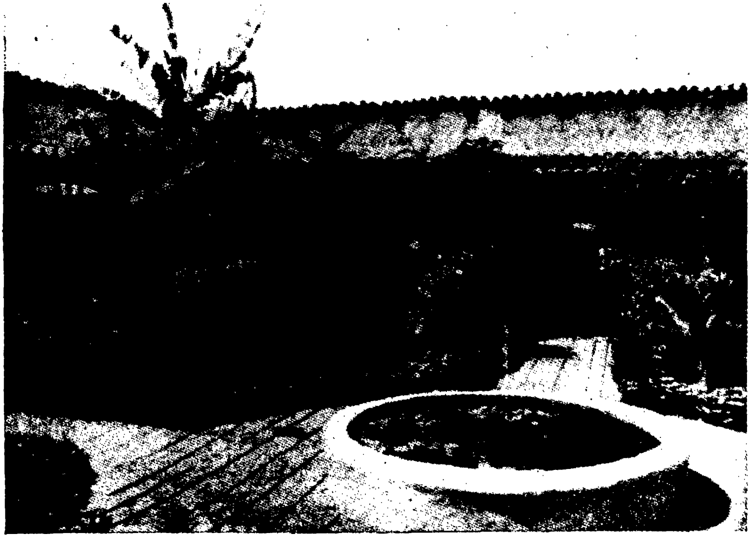


FIG. 148.—A formal garden in California.

Formal Style.—The architectural or formal style of landscape gardening may be successfully applied to a small lot although to most people the natural style seems preferable (Fig. 148). Some lots may even demand a formal treatment, for instance, one with a very steep slope which must be terraced, and so in its very structure is artificial. Man-made things are suitable for it, fountains, pergolas, statuary, steps, clipped trees, and hedges, and conventional shapes for grass plots, flower beds or water surfaces.

A well-designed architectural garden plot is better than a forced naturalistic effect.

In this style drives and walks do not follow the flowing lines of the naturalistic style, they are not to be subordinated to natural objects, but they follow straight or circular lines according to a symmetrical balanced scheme worked out for the grounds (Fig. 149). Lawns in formal gardens which are not kept closely shaven have an unkempt look, which is not acquired by the grounds planned in the natural style when the grass of the lawn is allowed to grow high. Shrubs and trees are planted in geometrical lines to follow the lines of walks and drives. Hedges and trees, like the lawn, must be kept well trimmed and should be as nearly uniform in color, size, and shape as possible. Flower beds or bedded plants are appropriate features pertaining to this style. These beds should be of a size and shape that will admit of flowers being gathered from the edge, and in outline they should conform to the contour of the area in which they are set or which they surround, that is, rectangular beds in rectangular strips of lawn and circular beds in circular lawns.

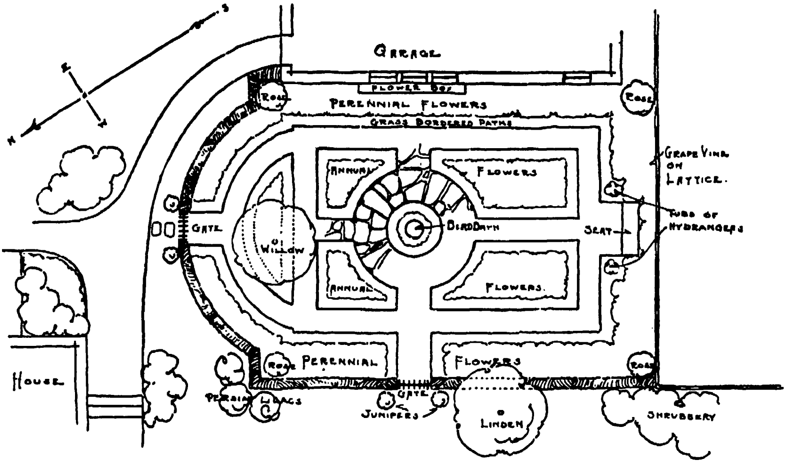


Fig. 149.—Plan for a small, formal, flower garden.

What has been said as to the selection of plants for the naturalistic treatment of grounds holds for the formal style as well. They should be considered as to permanency and appearance at all seasons. Native plants are better than foreign and there should be no overcrowding.

Birds.—We can add still more to the joys our grounds give us if we will consider the birds and provide them houses, baths, and protection (Fig. 150). It is a delight to watch their house-keeping and their family life. Their songs give us pleasure and their bright plumage and their flights across the lawn and against the sky add decorative effect to our own outdoors.

FIG. 150.—A desirable tenant and neighbor.

Garden Gate.—A garden gate is an attractive feature which may be used in either style of landscape gardening. It may be placed at the entrance to the formal flower garden or to the vegetable garden or it may be at the entrance from the street to the grounds. The style of the gate must vary with the style of gardening and with that of the house. A simple latticed or rustic vine-covered gate is appropriate for the natural style, while the formal garden should have a gate of more formal architectural design (Fig. 151).

A Democratic Art.—Landscape gardening is, in a sense, a democratic art, for it is applied to public parks, cemeteries and town sites where all may enjoy it, as well as to privately owned grounds for the pleasure of a few. It is an art practised as a profession and yet one in which almost any home-maker may adventure. Any one with grounds to plan should remember that artistry in landscape gardening depends upon the application of the principles of design to the expression of beauty in vegetation, that good taste and knowledge of horticulture are both essential. Some of the advantages of gardening are that mistakes may be dug up, that each season many minor changes may be made in the garden scheme, that it may be practised on a large or on a miniature scale and that it affords recreation and amusement all the year round and year after year.

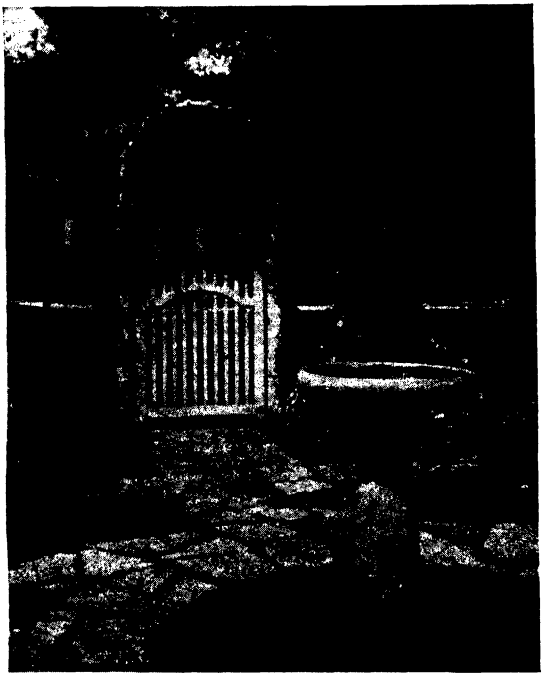


FIG. 151.—View of the bird-bath and gate in the garden shown in FIG. 149.

PROBLEMS

1. Describe the principal features of the landscape of the country around your home.
2. Find out what are the chief native trees. What common characteristics have these? Describe two or three of the most important. Repeat for shrubs and flowers.

3. What flowers are the earliest to appear? Which are the last?
4. Look for examples of the formal style of landscape gardening and for examples of the natural style.
5. See if you can find grounds in which are only native trees, shrubs and flowers.
6. Look for houses which are "tied to the ground" by means of plantings.
7. Which residence street in your town is the most pleasing from the point of view of landscape gardening? Why is it most pleasing?
8. What trees or shrubs in your locality furnish food for birds, or offer nesting places?
9. What trees and shrubs in your neighborhood are attractive in winter? What makes them so?

*10. Plan the grounds for your house on the lot you have selected.

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* The starred problems are those of a connected set running through the book.

CHAPTER XV

THE BUSINESS OF BUILDING

Methods of Getting Work Done.—A house may be erected by day labor, the owner furnishing the material and supervision, or it may be put up by a building contractor who does it on a cost-plus-percentage basis, or who undertakes the work for a certain fixed sum. This last way is in the majority of cases the most satisfactory. In order to be able to figure the cost, the contractor must know exactly what is wanted and in order to have no misunderstandings the requirements must be put on paper. Then there must be a written agreement between the owner and contractor in which the obligations of each are stated, and in which each agrees to fulfil these obligations. Any one who undertakes to see a house through from sketches to "broom clean premises" should be artist, lawyer, and jack of the building trades. This is what the trained and experienced and naturally gifted architect is. In order to properly fulfil his duties to his client and to the contractor who undertakes the work, and to the public whose rights both owner and contractor are sometimes willing to ignore, he must be as well a man of business ability, and proven probity. The building of a house is no work for an amateur, but, as in all matters the intelligent coöperation of the owner, even though he be an amateur, his personal oversight, and his understanding of the points involved in the business end of house building as well as his understanding of the drawings, generally are aids in securing satisfactory results.

Contract.—In letting a contract the documents on which it is based are the "Drawings," the "Specifications," the "General Conditions of the Contract" (this last may be put into the specifications or into the contract itself), and the "Agreement" or contract. These together are called the "Contract Documents."

Drawings.—The drawings must be working drawings, that is, drawings to such a scale as will show the thickness of walls, the sizes of openings, the location of plumbing fixtures and piping, *the location* of lights and switches, the location of heating outlets, the shelving in pantry and closets, and similar features, with spaces for the lettering in of the necessary dimensions.

Drawings for certain features of the house, such as fireplaces, built-in bookcases, buffet, archways, panelling, stairways, and pantry and kitchen built-in arrangements, must be furnished and also drawings for window and door trim, base board, picture moulding, cornice, blinds, porch railing and other details when these are not ordered from stock.

Specifications.—The specifications cover qualities of materials used, methods of work, care of property, and disposal of refuse. Directions should be given in this paper for the following items, and others as the type of house demands:

1. Excavating, care of top soil, grading.
2. Composition of concrete.
3. Thickness and construction of cement floors.
4. Character of stone work, quality of stone.
5. Grade of bricks and method of laying.
6. Method of framing and size and quality of rough lumber.
7. Laying of sheathing and rough floors.
8. Insulating and deadening material.
9. Fire and vermin stops.
10. Quality and treatment of laths.
11. Kind of plaster and sand, and plaster finishing.
12. Millwork, style and quality.
13. Interior and exterior finishing lumber and method of putting in place.
14. Nails to be used in different parts of the work.
15. Kind of tiling and method of laying.
16. Hardware, kind and quality.
17. Shelving.
18. Electric wiring, by whom to be done and how, outlets, switches, fixtures, lamps.
19. Painting and staining, quality of materials, number of coats, method of work.

20. Make and size of furnace, guarantee as to heating, damper, chains, thermostat. Insulation for pipes and stacks, size and kind of registers or radiators.

21. Coal chute.

22. Plumbing, materials for pipes, sizes, connections, traps, vents, cut-offs, fixtures, fees and permits.

23. The time for doing certain parts of the work.

24. The condition in which the building and premises are to be left.

These are technical matters which vary with almost every locality and type of building, no set form can be given, and only a properly qualified person should attempt to write the specifications. An expert is also needed to see that the specifications are lived up to by the contractor, a contractor who is willing to slight his work can very easily deceive an amateur, and unless there is real supervision by a qualified person with authority, there is a great temptation for the contractor to neglect the work, in certain of its phases. Supervision is part of the architect's work. To be sure of avoiding disappointment the owner should study every clause in the specifications and understand just what material and work is being called for; by so doing he will be sure to get what he wants, and to save where he can.

General Conditions of the Contract.—The document called "General Conditions of the Contract" is one in which are drawn up those conditions which have a bearing on drawings, specifications, or business relations. In this document a great many points should be covered including the issuance of certificates of payment, payments to the contractor, his payments to his employees and for materials, the carrying of insurance, the contractor's liability, adjustments, liens, and similar matters. These are much the same in any place and although the state laws should be consulted a standard form may be used. Such a standard form consisting of forty-five articles with subheads under these, covering the points to be agreed upon, is put out by the American Institute of Architects. This standard form has been approved by the National Associations of many of the building trades. The general conditions of the contract are designed to protect owner, contractor, and architect. The owner should understand every point in this paper also, and know that any violations of the contract on his part, or waiving of the least formality jeopardizes his interests.

Agreement.—The "Agreement" is a legal paper defining the duties of the contractor and the terms upon which he assumes them. This paper stipulates that materials are to be provided and work done as shown on the drawings and described in the specifications and as required by the general conditions of the contract. The American Institute of Architects publishes also a standard form for the agreement. Many architects use these standard forms, filling in the blanks as the circumstances require.

Cost of Building.—*It is impossible to give figures of much value as to costs of building for these fluctuate over wide margins during any period of months and they vary greatly in different localities. Local variations are due to the sources of supply of materials, to the prevailing wages and to the amount of work the contractors have on hand. Usually the frame house is the cheapest to build, but the day is not far distant when, due to the depletion of our forests and to improved methods of construction, houses of other materials will be the cheapest.*

Variations in Cost.—Cost varies with the type of construction and the time and place where the building is erected. In 1931 the American Face Brick Association obtained figures on two houses, one of two stories and six rooms, the other of one story and five rooms, to compare the cost of frame and of face brick construction. The cost varied in different cities according to local prices of labor and material. It varied also with the type of face brick wall construction. The average cost of the six-room house was about $8,500 and that of the five-room house about $6,500. The table shows the additional cost of face brick over frame in certain cities. Hollow tile, concrete and steel houses also cost more than frame to build. When the total costs of these different types of construction are figured over a period of years, it is possible that the types which cost more than frame to build may be cheaper in the end, for the cost of repairs, painting, and insurance depends upon the type. However, it is practically impossible to give accurate weight to all these factors and so to foretell exactly the long run costs.

Additional Cost of Face Brick over Frame in Certain Cities

City	Extra Cost	
	From	*To*
6-room house		
Atlanta	3.6%	7.6%
St. Louis	7.0	9.1
Decatur, Ill.	6.1	9.1
Chattanooga	4.8	7.9
Columbus, Ohio	5.4	9.3
Harrisburg, Pa	1.5	4.1
Minneapolis	6.0	7.7
5-room house		
Atlanta	5.7	9.1
Minneapolis	5.6	7.6
Memphis	4.9	6.4
Canton, Ohio	3.2	5.3
Harrisburg, Pa.	3.4	5.8
Average	4.9%	7.4%

While a practicing architect can estimate the cost of a proposed building and knows what type of construction will be cheapest, the only accurate way to determine the original cost is to take bids on the plans.

The owner should remember that any changes made after the contract has been let mean as a rule a considerable additional cost. When the owner pays for materials he should realize that he can save money by paying for them promptly after their delivery, for a discount is usually allowed if this is done.

Methods by Which to Approximate Cost.—The best way to approximate the cost of any contemplated house is to compare it with the cost of houses recently built in the same locality. One basis for comparison is the cost per square foot. The total cost of a house divided by the floor area gives the cost per square foot. Of course, this comparison must be made for houses of the same number of floors. Another better way of getting a rough estimate is by ascertaining the cost per cubic foot. This is obtained by multiplying the floor area by the height to the top of the roof, and dividing the total cost by this. The general shape of the house, the number of jogs, the special features, all make wide variations in the cost per square foot and in the cost per cubic foot. The square house is usually cheaper than any other shape enclosing the same area. Two houses practically the same as to size and general features may vary greatly in cost because of the quality of materials used and the workmanship required. These things must all be taken into consideration in estimating the cost of a desired house. Materials purchased during a slack time may often be bought at a bargain, and this fact also has a bearing on the matter of cost. Using stock millwork and standard lengths of lumber is always an economy.

Payments to Contractors.—The contractor is as a rule paid certain stipulated sums at different stages of the work. The contractor submits to the architect an application for each payment. The architect sees his receipted bills for materials and satisfies himself that the workmen have been paid and that the work has been properly done before issuing a certificate for the amount due, which the owner then pays. Should any contractor fail to pay for materials or labor, the amounts due for these may become liens on the building. The final payment should not be made until after the expiration of the time in which liens may be filed upon the building and until it has been established that no liens have been filed, or, if there are any liens, until these have been satisfied. As a rule mechanics liens must be made within thirty-five days after the notice of completion of work has been filed.

Time for Building.—Building is a complicated business, different sets of workmen must come and go, and must wait upon each other, for they do their work at different stages in the construction; the plasterer cannot plaster until the frame work is up, the millwork cannot be put in place until the plastering is done, the plumber must rough in before the plastering is done, and set up the fixtures afterwards, the painter should come along at different stages, and also the electrician. In order to get work done without delay, to keep workmen busy, to be able to work for a small profit on each job, a contractor needs to have an extensive business and to be a very good administrator. In dull seasons a contractor will often take a job at a nominal profit in order to keep his men employed; during a rush season contractors may refuse to bid, or each try to slightly overbid the other, in order not to have to bother with a small job. Often there are combinations among contractors in a certain locality for dividing up the work and keeping up the profits. An established architect usually understands these situations, and if the owner is willing to wait for his house, the architect can sometimes save him money. It is well to dream over a house for years, to work out sketches of arrangements, to estimate cost, to collect pictures of attractive features, fireplaces, stairs, entrances, to study general appearance of exteriors, and to collect pictures of these also, to study the neighborhood and the lot selected over a period of months, then to write out requirements and to go over these time after time, to see what can most easily be spared if it becomes necessary to eliminate some feature, and finally to take to the architect the requirements we have decided upon together with any sketches and pictures which may help him to get our ideas. The architect should not be rushed if it is possible to avoid it, and if he is given the work in a slack season he can give better attention to it. Professional advice should be sought as early as possible, even before the purchase of a lot, for an architect may be able to give valuable advice on this matter due to his knowledge of local conditions. Unfortunately, most people build in a hurry, they do not think out clearly what they want, they push the architect for the plans and then they want the house put up at once. If the opposite of this were true, there would be greater satisfaction to the owners, and possibly a saving of money as well.

PROBLEMS

1. Do you know of any one who has had a carpenter build for him without drawings and specifications a house or a room or a porch? What was the result?
2. What would be the advantages of building on a cost-plus-percentage basis? What would be the disadvantages?
3. What knowledge and experience should a person have to undertake to buy the materials and supervise the building of a house by day labor?
4. What is the cheapest material for house building in your locality? Why?
5. Find the costs of a small house and of a large house in the same place built at the same time, the two houses to be of approximately the same quality of material, and compare them as to cost per room, and per cubic foot.

*6. Go over the list of topics which should be covered by specifications, and if you know what you want to specify for your house in any of these make a note of it.

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* The starred problems are those of a connected list running through the book.

7. What do architects charge in your community for (1) a large business building, (2) a small house? Why is there this difference?
8. If an architect were not available for drawing up the specifications what steps might be taken to insure satisfactory materials and workmanship?
9. How can you find out what permits must be obtained for minor and for large building operations in your community?

CHAPTER XVI

ALTERATIONS

Reasons for Remodelling.—It is frequently the case that a well-built house in a good location becomes undesirable as a residence because it is not suited to present-day conditions of living. It may be too large, it may be too small, its ceilings may be too high, its windows too small, its appearance may be bad, it may be utterly lacking in modern conveniences. It is a great pleasure to see substantiated in brick or stone or timber a house of dreams, and there is also a fascination in the work of making a comfortable and beautiful dwelling out of one which is destitute of conveniences and charm. Some of the most engaging problems in planning and designing are those involved in remodelling old buildings. Doubtless ever since men began to build they have seen ways in which they could improve their work, and doubtless they will continue to see room for improvement and reasons for alteration as long as they continue to build.

Some of the most interesting remodelled buildings are the feudal castles which during the Renaissance were lightened by large windows cut into their thick walls, enlivened by the addition of arcades, and beautified by gardens where formerly were moats and fields of conflict. Temples have been changed to suit the requirements of Christian worship, churches have been made into mosques, palaces have descended to the service of commerce. To-day we see mansions converted into factories, and the large house made over into apartments, wings added to small houses, barns transformed into dwellings, plumbing, heating and electric systems installed, and the whole aspect of a house changed by a coat of plaster, the removing of gingerbread ornament or the building of a dormer window.

Method of Approaching Remodelling Problem.—Remodelling is only too likely to result in a patched-up, confused scheme unless the complete project is carefully studied and worked out on paper. The owner instinctively feels this and often defers

Cost.—There are houses which cannot be successfully remodelled, and houses which can be successfully remodelled only at a cost which is out of proportion to the advantage gained. This may be due either to the style of the house or to its state of repair. It does not pay to remodel unless the old part is put into good condition, and this sometimes is more expensive than to build new. The cost of remodelling is difficult to figure. The cost of an addition or of putting in a heating or plumbing system may be estimated more accurately than that of changes in structure.

The Old-fashioned House.—In the years after the Civil War while there was a temporary shortage of commodities and consequently high prices, there was also an unsettled West of virgin soil and untrodden forests and undiscovered wealth of minerals and water-power. Into this West went immigrants, native Americans and foreign born. Labor and help for a while were abundant, and soon the West began to send its contributions of food, lumber and other raw materials "back East," an East gradually advancing from the Mississippi westward. The generous supplies of material and of labor and the instinct to pattern after the dwellings found in eastern cities led to the building of solid and substantial large houses with wide halls, large rooms and high ceilings. Sometimes these houses were square with wings attached, sometimes they were long and narrow, usually they were high. With the gradual settling of the country, with the decreasing fertility of the soil and the increasing depletion of our natural resources, with a growing servant problem, the expense of comfortable living in such houses requires a larger proportion of the income than it formerly did. Alteration to make these houses suited to the economic conditions of newer times becomes desirable. Making such houses into two or more apartments is the natural solution of the difficulty. Usually it is possible to keep the original partitions, and because most of these are supporting walls, it is a great saving of expense to keep them. If supporting walls are removed, brackets, beams or trusses must be supplied to support the story above. Invariably, new windows must be cut and often courts or light shafts built to give light and air to the subdivisions of the large rooms. Frequently it is an economy to tear out the old stairways and to build new in order to gain floor space and to have the stairs in more desirable situations. Such extensive changes may not pay unless there is a steady demand for the type of apartments which can be made from the old house (Fig. 152).

While comfortable, cozy and sanitary apartments may, by the exercise of all one's igenuity, be contrived from such a house, the exterior presents a far more difficult problem. To begin with, the high windows and the roof, mansard perhaps, or towered and turreted, stamp the house archaic beyond the possibility of remedy. The cutting of new windows and the addition of balconies do not often improve the appearance. As a rule, owners are satisfied with the alterations of the interior and do not attempt to modernize or beautify the exterior.

The services of an architect are almost a necessity for making such extensive changes as are involved in making a house into apartments, but unless a whole row of houses is to be rebuilt the architect does not, as a rule, care for the job unless the owner can go to him with an intelligible plan, an understanding of the difficulties involved, and a realization of the limitations imposed by the form of the existing structure and by the local building code, which, inadequate as it usually is, often imposes expense that an owner would fain avoid unless he happen to have a civic conscience

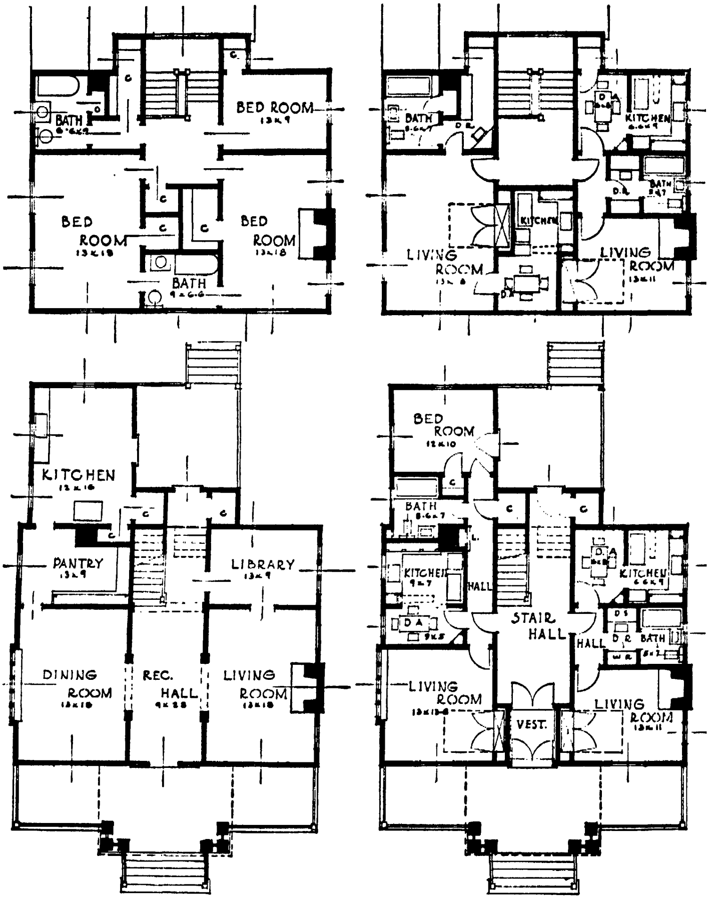


FIG. 152.—An obsolete house made into apartments.

and understands the wide-reaching effects of housing conditions.

Additions.—An addition to a house does not present the same difficulties as replanning does. The main considerations are, first, the proper articulation of the addition with the original structure, second, the exterior appearance; these two, of course, must be studied together. If additional living space is required it should adjoin that already existing, if bedroom space is to be added the approach to the bedrooms, access to the bathroom and privacy are the prime considerations. If the house is to be enlarged in both these ways the problem is more complex. A wing should have the appearance of being an integral part of the house, not an appendage, but it should be subordinate to the main mass of the house, and it should add to the interest of the building. It is not always easy to attain this ideal in building onto an existing building. There is danger of having an unbalanced appearance of mass, roof, wall space and openings, or in the location on the lot, and each of these factors must be carefully studied to secure an harmonious design. The materials and the units of design used

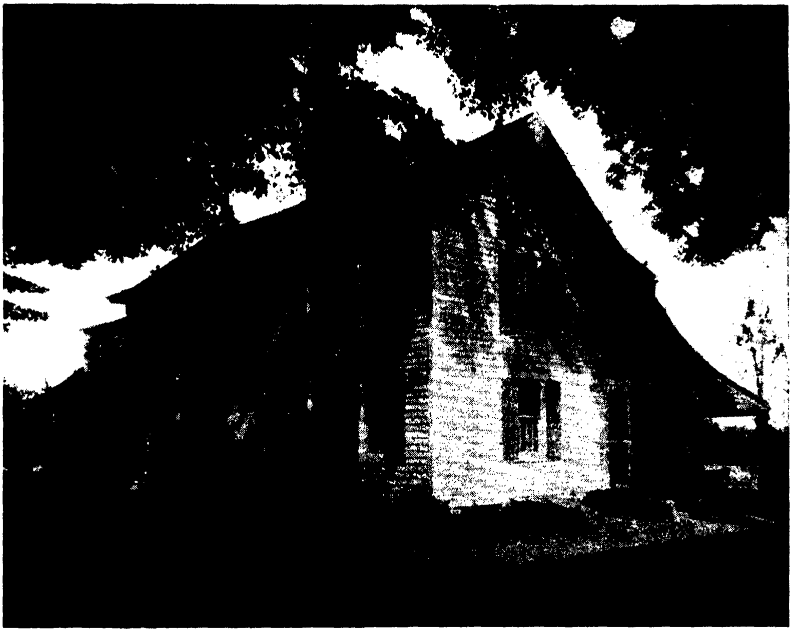


FIG. 153.—Front view. showing the old house with the new wing at the left.

in the addition should be the same as in the original building (Figs. 153-155).

Frequently in alterations we have a replanning problem and one in enlarging as well, as when a barn or a small house is taken as a nucleus for a larger building. Sometimes, however, this problem does not offer as many difficulties as the one of adding to a house without change in the original structure.

Details.—In making alterations the details must be as carefully considered in relation to plan and to design, as the larger features. The chimney breasts, and mantelpieces of old houses present difficulties in the way of alterations. If none of the flues running up the chimney breast are to be used it may be torn out. Fireplaces aid in ventilating a house and often it is well to leave them for this purpose. A fireplace used only for ventilation should have over the opening, a pierced screen which may be removed to clean out dust and dirt which blow down the flue. The mantelpiece should be removed if it happens to be in a space used for kitchen, bathroom, or a small bedroom. In other rooms, if too cumbersome or ugly, it may be replaced by a new one.

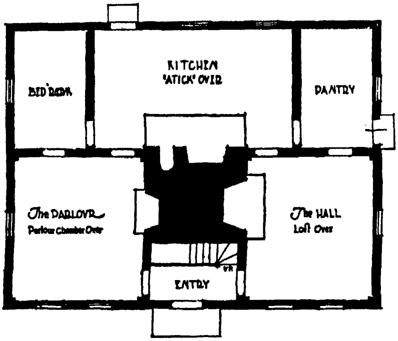


Fig. 154.—The old plan.

Often the woodwork in old houses is elaborate. There are wainscots and high base boards, inside shutters and elaborate trim, often of hard wood. To match up these in the new work would be far too costly, and often the cheapest course is to take them out and replace with stock. If the design is good, some of the rooms may be stripped to finish other rooms with the old material, new being used in some of the rooms. Solid panels from inside shutters may be used to make a wainscot. When new woodwork and old occur in the same room, paint will harmonize the two, even if the old is made of many mouldings and the new is plain. Grooves, channels and gimcracks, dust catchers troublesome to the housewife, when they cannot be done away with may be rendered less obtrusive by the use of a carefully studied color scheme, one which allows no sharp contrasts between woodwork and walls, and one which assigns to the woodwork a color and finish which does not show dust.

New floor finishes are almost invariably needed when an old house is remodelled; since the existing floor is, however, as a rule, good for a foundation, parquetry, composition and linoleum may be used to advantage.

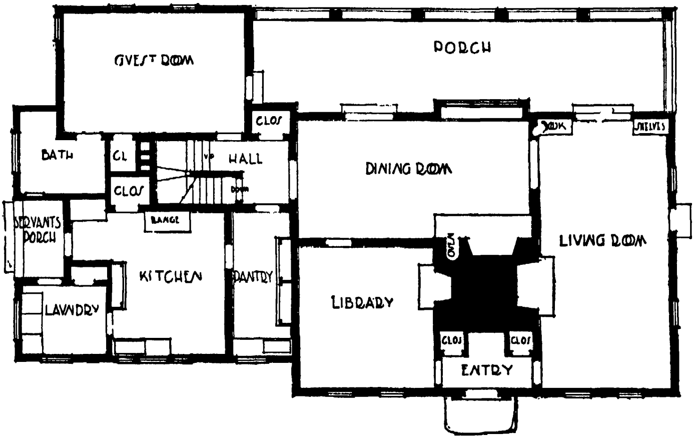


FIG. 155.—The new plan.

Small Changes.—Many times a great improvement may be made in a house by installing a heating plant or a bathroom or electric lights, by rearranging the kitchen, by changing doors and windows or by the addition of a porch. A small change such as one of these may make an immense difference in a house as to the health of the occupants, the ease in doing the work, its appearance, and its salability.

In the new house plumbing, heating and lighting systems are installed before the plastering is done and the stacks, vents, pipes, and ducts are out of sight within the wall spaces. When putting these improvements into an old house warm-air ducts must be run upon the surface of the walls unless comparatively large areas of plaster are torn out. Some of them may be run up in closets, others may be boxed in forming pilasters so disposed as not to spoil the appearance of the rooms, or interfere with the placing of furniture. Hot-water or steam-heating pipes may be slipped up from the basement through the spaces behind the plaster and only a small area of this need be cut out. The vertical pipes for plumbing may also be put into place within the walls without much difficulty. Sometimes a large soil pipe must be boxed in if it cannot be run out of sight through a closet. To avoid cutting up large areas of floor the fixtures should be as close to the stack as possible. If the different sets of fixtures are scattered through the house and not nearly directly over each other a separate stack for each set is better than connecting all to the same stack, because the latter alternative would necessitate more tearing up of floors. Electric wiring may be concealed by moulding, but it is better to lift enough of the flooring to run the conduits underneath it.

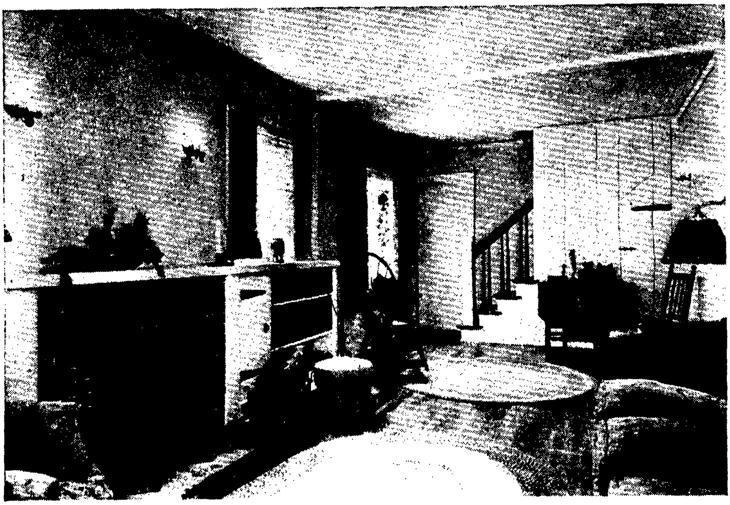


FIG. 156.—Two small rooms made one by the removal of a wall at the line indicated by the break in the ceiling. A small stairway has been built to reach a studio in the garret.

In many houses an unnecessarily large kitchen, or a poorly arranged kitchen, makes the work in those houses harder than it need be. Sometimes there is also a large pantry which might be done away with. In such a house a few alterations such as tearing out of a partition and building a new one, may provide a more convenient kitchen and space for a laundry as well.

Making wide doors between living rooms, cutting a window in the wall of a dark room, or adding a bay window frequently makes a cheerful house of one previously gloomy.

The addition of a porch increases the living area of the house for the summer months and if it is enclosed for the winter months as well. A porch on the windy side of the house is a protection. When building on a porch care must be taken that it does not darken too much the adjacent room, or if it does darken the room considerably, to increase the window area of this room.

Exterior Alterations.—One should proceed with the exterior alterations as with the plan by making a careful drawing listing the defects and studying designs of similar structures for ideas. More than this, the surroundings should be studied and analyzed to see what types, materials, and colors of those available are best suited for use in the remodelled house. Often the effectiveness of a house of good general proportions and shape is spoiled by complicated or uninteresting roof lines, lack of balance between roof surfaces and walls, poor arrangement of windows and doors, incongruous ornament or a bad color scheme. All of these faults may be remedied with more or less work. A roof may be rebuilt according to a design which reduces the number of surfaces and angles, or a gable or dormers may be added to lend interest to surfaces too flat and unbroken, or to carry up the wall space when there is too little of it in proportion to the roof. The tall and narrow appearance of a house due to a high cornice line and low-pitched roof may be corrected by long roof lines, bringing the eaves down over the second story and continuing over a porch if there is one, thus giving the house better balance between walls and roof. Windows of different shapes and sizes with the tops at different heights and with lack of rhythm in spacing, which break the unity of the design, may be removed and in their stead windows and doors similar in style arranged so as to be decorative features leaving wall spaces of shape and size agreeable to the eye. Nonstructural ornament is generally easily removed. In the small house the interest should come from good proportions with accent given by the openings and the shadows cast by projections and not from the use of several materials and the marking by color of rafters, mouldings, porches and other features. The walls of a house may be entirely resurfaced to do away with patchiness due to the use of several finishing materials, or the patchwork effect may be blurred by painting the different materials the same color. A coat of plaster may be applied upon metal lath, attached to the old siding or shingles, or to wood lath fastened to furring strips nailed to the old finish. A brick veneer may be built up over the old walls or the old finish may be ripped off and a new one put on.

When alterations are made primarily to improve the interior arrangements their effect on the exterior appearance should be carefully studied to avoid introducing elements out of harmony with the design, elements which may upset the balance, the rhythm or the unity of the original structure. Thoughtful study of the relation of any alteration to the existing building, consideration of it from every angle of the points of view of use, appearance and cost, together with accurate planning, are essential for securing the best results when making changes, great or small, in any house, old or new.

PROBLEMS

1. Look for houses in your community which have been remodelled: (a) successfully in every way (b) as to comfort and convenience and (c) as to appearance.
2. Choose an old house in your town and make plans for changing it into apartments.
3. Sketch the plans of some house or apartment you know which is poorly arranged and make plans improving the arrangement.
4. Select a house of unsatisfactory appearance. Write out a criticism with an analysis of why the house is unpleasing. Suggest changes and make a sketch showing these.
5. Select a large house and plan to remodel it for a family of father, mother, three little children, and the mother's parents who wish a suite for themselves.
6. Draw the plan for a house twenty-four feet square, of four rooms each twelve feet square. Plan an addition and the remodelling to make of this a five-room house with bathroom, closets in bedrooms and a basement.

CHAPTER XVII

THE FARM HOUSE

Differences Between Housing Needs of Farm and City Families.—A farm house must satisfy requirements which in many respects differ from those to which a suburban, a town or a city house must conform. As the income, or the size, or the needs of the family, or some other consideration make it advisable, the city family can move with little difficulty to a house which suits its purpose. If the farm family needs different quarters from those it has, the matter is more difficult. The farmer cannot go out and rent or buy a new house as the town dweller can and keep the same connection with his business that he had before, for the farm home is part of the farm, one cannot be abandoned unless the other is. Therefore, when the house no longer fits, there is nothing for the farmer to do but build a new house or remodel the old. Farmers' sons and daughters are sometimes crowded out of the house and driven to the city, simply because there is no house room for them, in spite of the fact that it would be to the economic advantage of the family for them to stay and work on the farm. The farmer should, then, in building a home, plan it so that it may be added to in time, for not every house can have an addition built on successfully. The farm house, if small, should be planned to grow and if large should be planned to shrink so a small family may live in part of it comfortably with a portion shut off, for families have a way of waxing and waning with the years, and sometimes seasonally.

The town dweller must build his house to conform to the size and exposure of his lot and the restrictions of the subdivision in which he elects to live. The farmer may spread his house over as much ground as he wishes and face it due south, or north-north-east, or whatever way is most advisable.

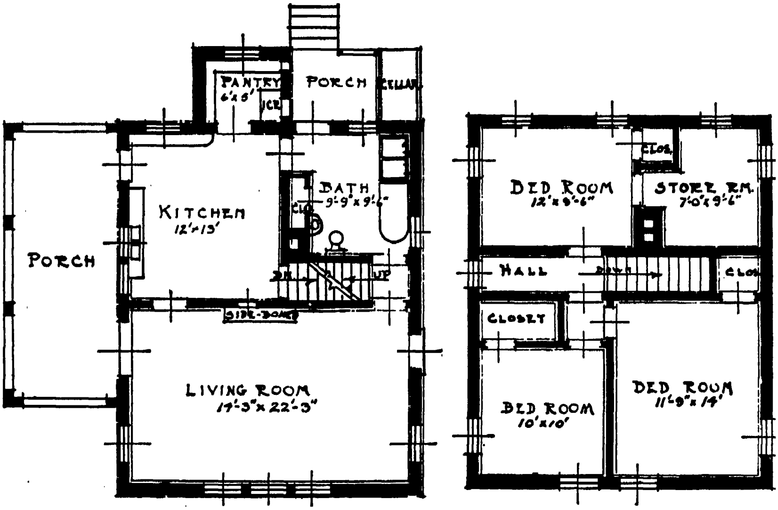
In spite of the easy and rapid communication and travel provided for by telephone, parcel post, interurban lines, and automobiles, the country house must provide things unnecessary in the city home. In the city, house-keeping supplies are purchased in small quantities, on the farm many of these are produced and must be stored for use. In the city, washing may be sent to the laundry, while in the country laundry work usually must be done at home. Besides, as a general thing, the farm home must be prepared to meet the needs of seasonal help, harvesters have to be housed and fed. In the city the income-earning members of the family attend to their work away from home, but the farm house is the business centre of the farm and so should have office room for the manager.

Farm work and chores begin before breakfast and end after the evening meal. The farmer comes home for meals from muddy or dusty fields and roads. The children return from school over the same fields and country roads. Men and children spend much of their leisure in the house in rough clothes bringing in more or less dust and dirt. Consequently, the family sitting room cannot be furnished with as delicate furnishings nor kept in as good order as if it were in the city. For this reason the farm wife likes to have a best room not in daily use. The old-fashioned parlor which under modern conditions in the city has developed into the living room still has a place in the farm home. Provision for house guests is needed, since there is no near-by hotel where friends may stay and because visitors are more important to the farm family than to the city family, as farm people have fewer opportunities for daily contacts with their fellows. On the farm there are not so many visitors coming in for a short visit as in the city. The members of the farm family use a back entrance for their rather frequent goings in and out.

The house should be set some distance from the road in order to avoid dust, but close enough to it that persons inside may see the passerby, for most of us are interested in the doings of our neighbors and those of the stranger as well.

Another most important condition for a desirable site for the farm home is that there must be at hand a constantly available supply of pure water, sufficient for all domestic purposes.

Planning a House to Grow.—In planning a house to which it is desired to make an addition in time, it is well to plan the addition at the same time that the original house is planned, keeping in mind all our rules of design, applying them to the part to be constructed first and to the whole structure as it is hoped it may eventually be built, in order that each of these may be well arranged and beautiful. Of course, it is desirable that when the addition is built there will be little tearing up of the original building. If a great deal of remodelling is necessary, involving changes in partitions, stairways, and even minor changes of doors and windows, it makes a very expensive job, one often costing as much as to build new (Figs. 157-161).



FIRST FLOOR PLAN
FIRST HOUSE

SECOND FLOOR PLAN
FOR FIRST HOUSE & FOR FIRST ADDITION

Fig. 157. Farm house planned to grow (See Figs. 158, 159, and 160.)

In building a house designed to grow, the original may have a room to be used for both living room and dining room which later may be the living room or the dining room alone. Perhaps the original house may have a breakfast alcove which later when there is a regular dining room may be turned into a pantry or store room.

In order to be able to close successfully part of a house for a season the part left open must contain everything required for the comfort of the people who live in it. So, again, in making our plans we must consider not only the whole house, but that part to be lived in while the other part is closed. The part to be shut up for a time should not have too many doors of communication with the part to remain in use, otherwise the open rooms will not have a pleasing appearance, heat will be lost, and dust will sift into the shut-off portions of the dwelling.

Farm Office.—The office which each farm house should have, where business matters pertaining to the farm may be conducted, need not be a large room and it may be located where it works in to the best advantage with the rest of the house plan. It should have a door to the outside or a door into the men's wash room so the farmer may use it without going through other parts of the house (Fig. 161).

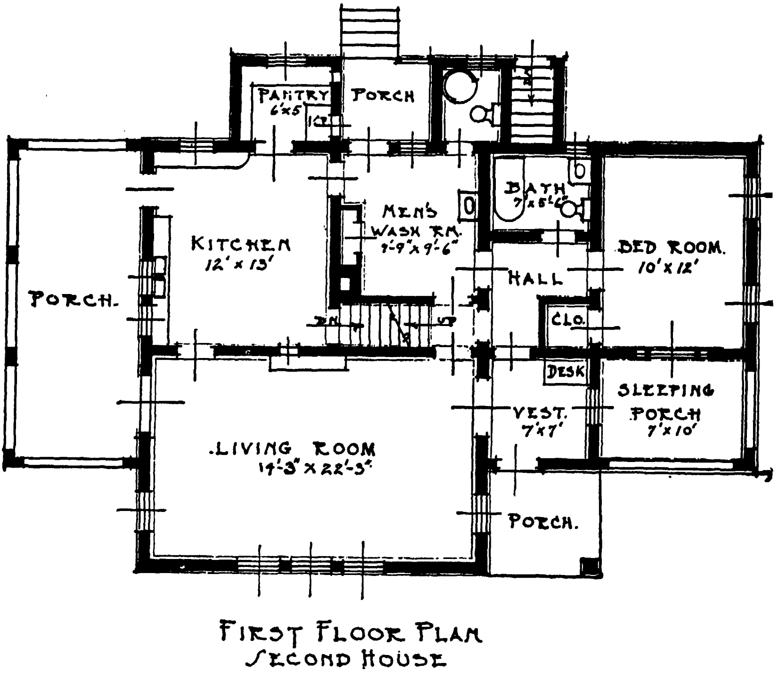


FIG. 158.—Farm house planned to grow. (See FIGS. 157, 159 and 160.)

Wash Room.—A wash room for the men working on the farm is something which many large and comfortable farm houses lack,

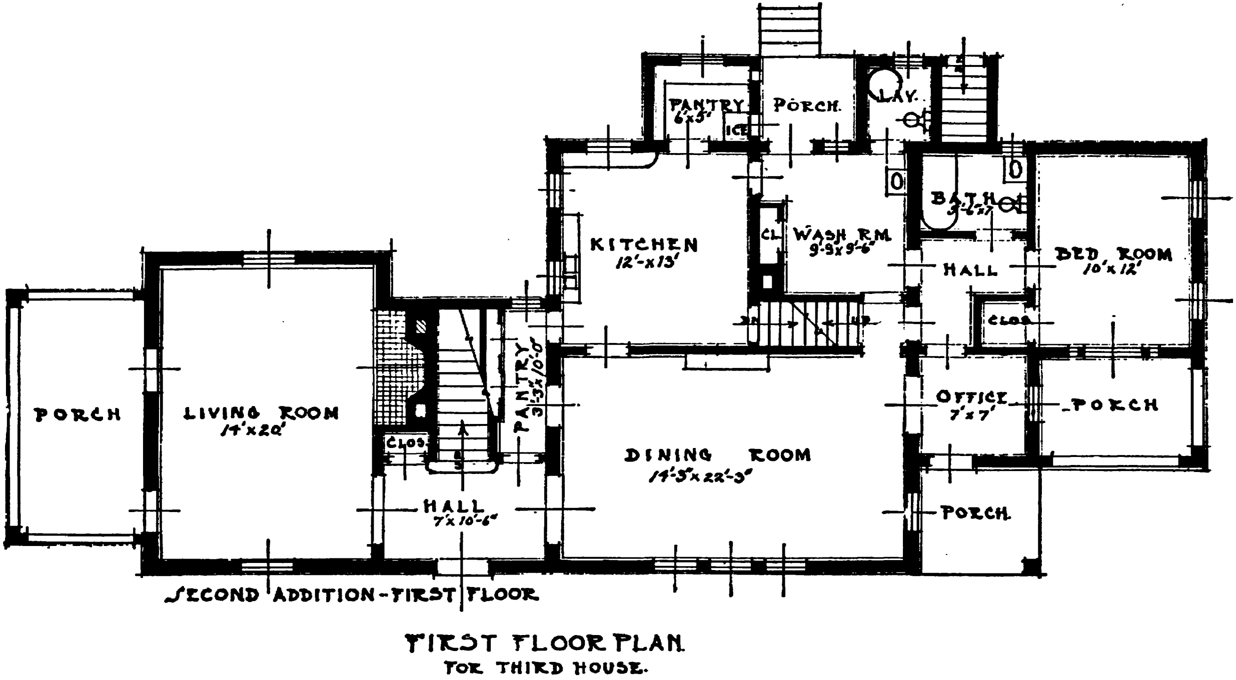


Fig. 159—Farm house planned to grow. (For the exterior of this house see Figs. 11, 12, 13, 14. See also Figs. 157, 158, and 160.)

but even very small farm houses need such a place where dirty boots and clothes may be removed before their wearers tramp through the house, carrying mud or dust with them. Using the kitchen for a wash room, dressing room, and barber shop, is unsanitary and inconvenient. If the house is so small that there can be no living room, if the kitchen must serve that purpose and be a dining room as well, there should nevertheless be this wash room, indeed, there is all the more need of it and it should be provided before either the living room or dining room. The wash room, besides communicating with the office, if there is one, should be near the dining-room in order that if farm hands are given their meals in the house there may be as little traffic through the house as possible. It should also be so placed that it will be the most convenient point of entrance on coming from the barn to the house in order that there may be no temptation to enter by way of the kitchen. The basement is not a good place for the wash room because it is not convenient, and there will always be the tendency to use

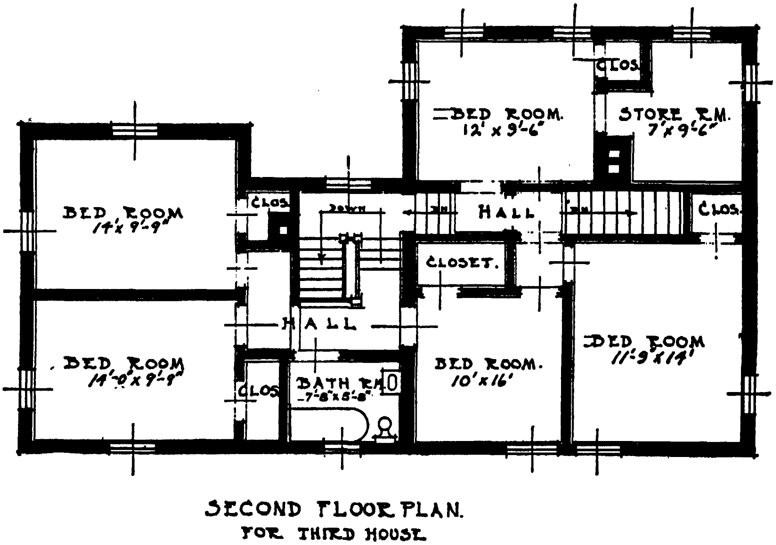
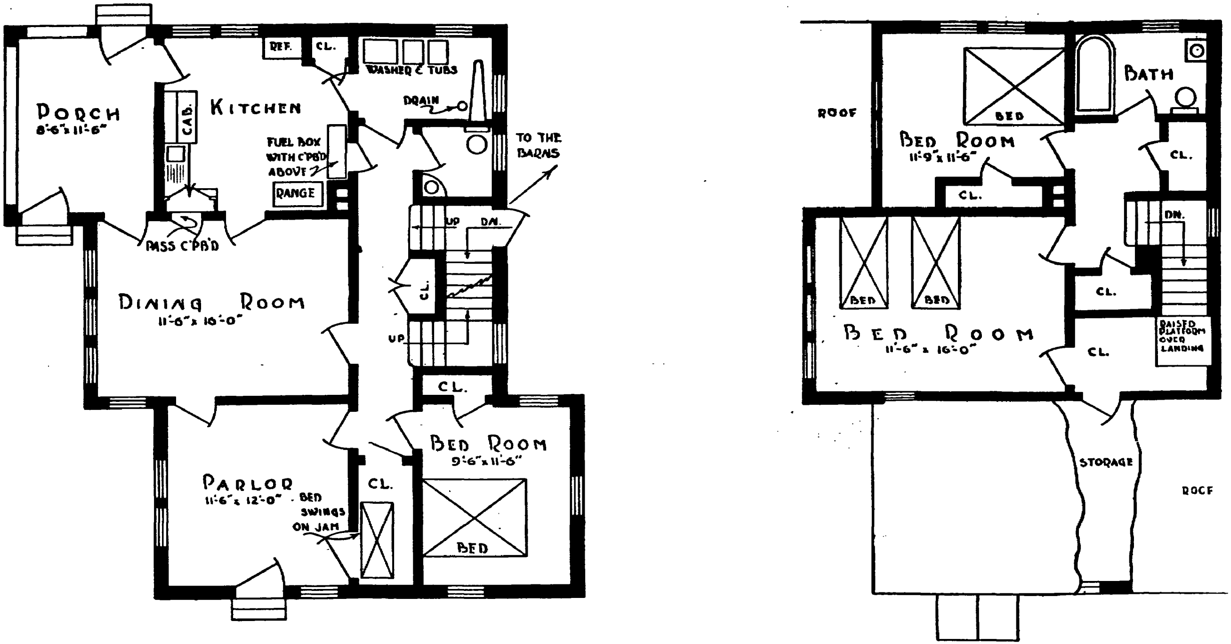


FIG. 160. Farm house planned to grow. (See FIGS. 157, 158, and 159.)



FIRST • FLOOR • PLAN

SECOND • FLOOR • PLAN

FIG. 161.—Plans for a farm house. The dining room, kitchen, laundry, and upstairs may be built first and the parlor and downstairs bedroom added later. The entrance for men and children is a grade entrance at the right. The wash room is reached from this entrance without the necessity of passing through other rooms. The farm wife may go from the kitchen through the porch to the garden and chicken yard. There is an informal entrance from the porch to the dining room and a front door into the parlor. The parlor has a wall bed and may be used as a guest room. Before the addition is built, the front door is at the foot of the stairs. The addition might be of two stories with one or two rooms on its second floor.

the kitchen instead. If farm hands live in the farm house the wash room may be made large enough to be used as a sitting room for the help, with a closet for hanging clothes, and from it the bedrooms for the help may open either directly or by means of a stairway to the second floor. In this way the privacy of the family is secured, for these rooms need have no communication with rooms reserved for the exclusive use of the family (Figs. 159 and 163).

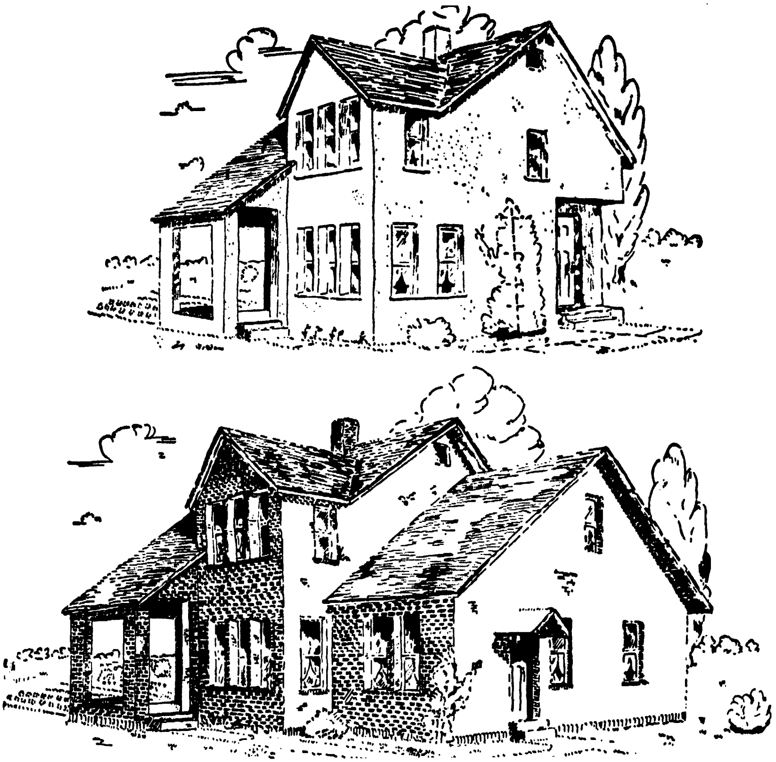
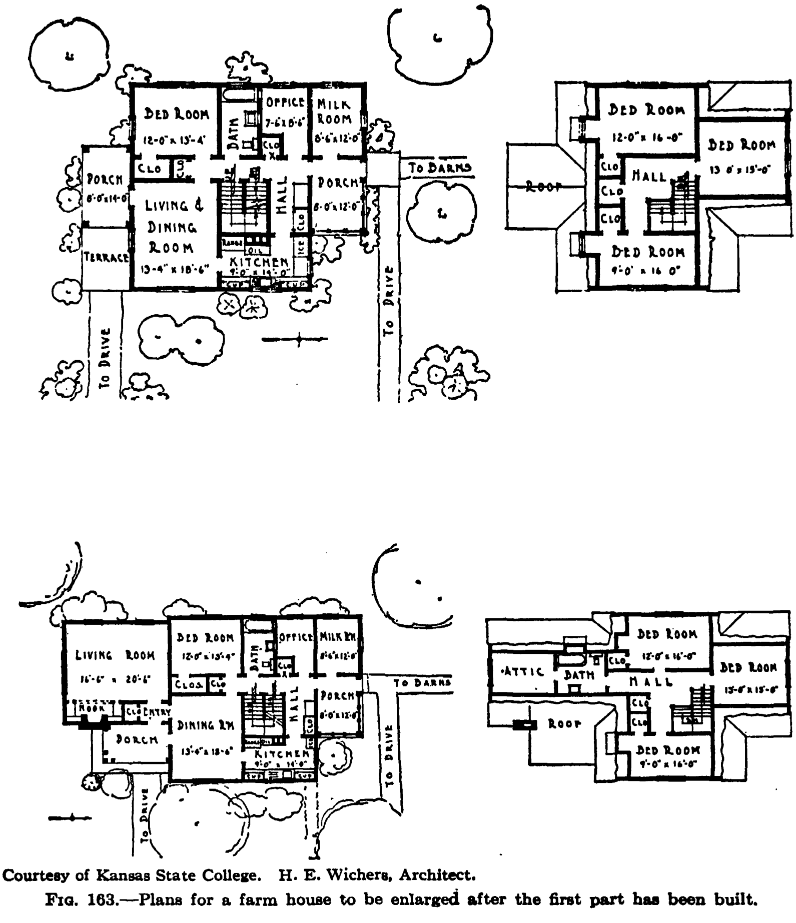


Fig. 162.—Views of the original and of the completed house shown in plan in Fig. 161.

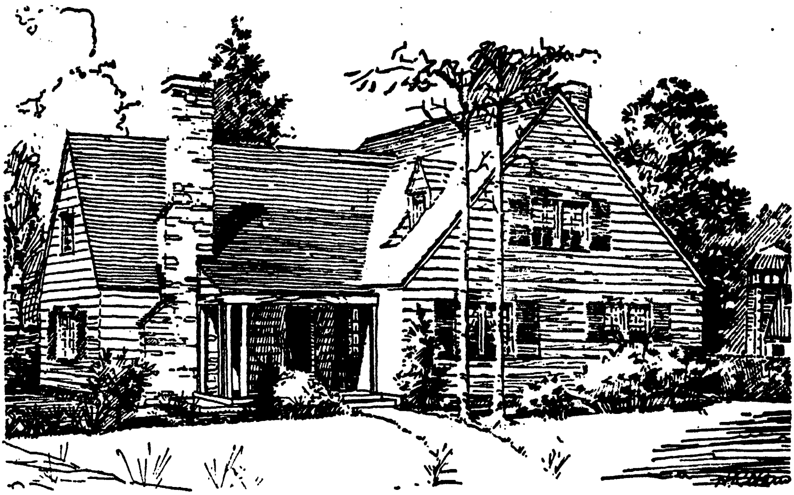
Food Storage.—More space is required for food storage in the farm house than in the town house. More foods are canned on the farm, fruits, vegetables and even meats, and much of the farm produce is stored in the cellar for use during the year. The



Courtesy of Kansas State College. H. E. Wichers, Architect.

Fig. 163.—Plans for a farm house to be enlarged after the first part has been built.

part of the cellar used for food storage should be shut off from the rest. This must be kept very clean, it should not be damp, it must be well ventilated, there should be provision for darkening it, and it must have an even temperature. To insure these things and sufficient space for everything that goes into the cellar, this storage must be planned for before the house is built. Some farm houses are not large enough to have cellar space for all the necessities of the house and for food as well, and a cellar is built apart from the house.

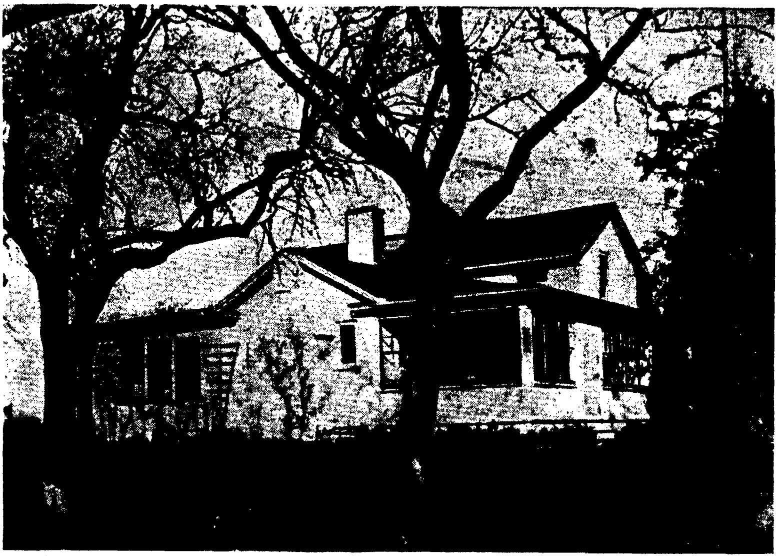


Courtesy of Kansas State College. H. E. Wichers, Architect.

Fig. 164.—Design for the completed house shown in plan in Fig. 163.

Connected Buildings.—It is convenient and it adds to the apparent size of the house to build onto the farm house the woodshed, the laundry, and the smoke house, and perhaps other buildings, such as a milk-room or cellar, which are often separate. Many of the old New England farm houses are built in this manner and the long low rambling effect so produced is one of the chief elements of the charm they have for us.

Fire-proofing.—Because farm buildings are isolated and do not have the protection afforded by modern fire-fighting apparatus and the expert knowledge of trained firemen and also because of the fact that fire may spread to the barns destroying valuable stock and stored crops, it is especially desirable that the isolated farm house be of fire-proof construction (Fig. 165).

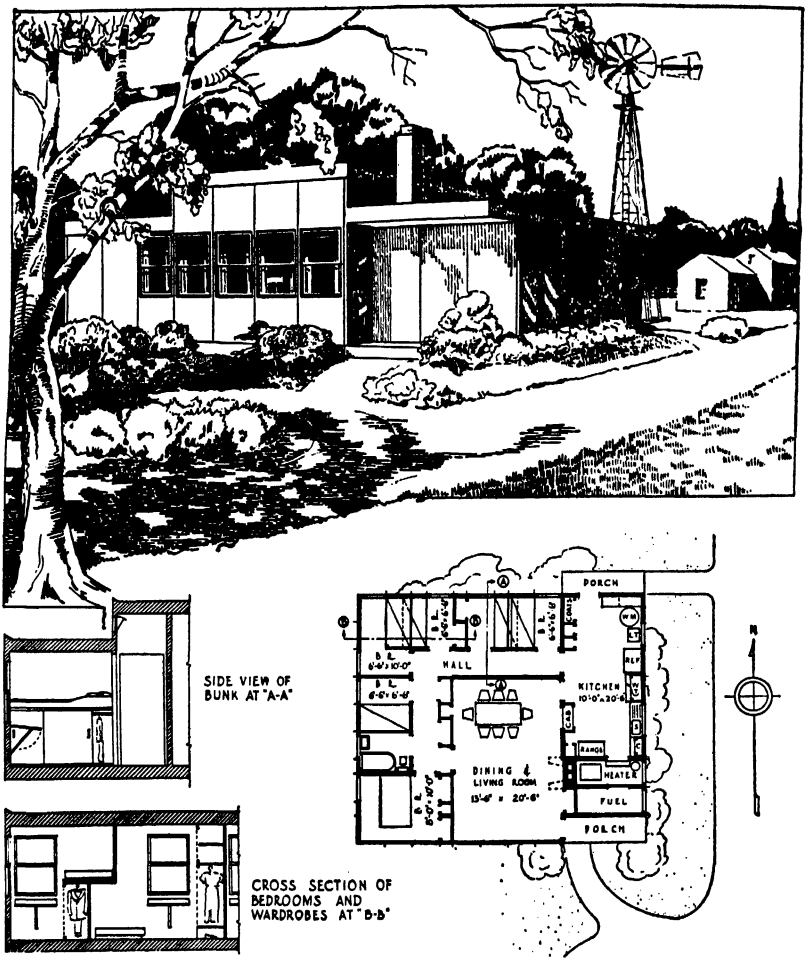


Courtesy Portland Cement Association.

FIG. 165.—A fire-proof concrete farm house in Racine County, Wisconsin.

Water Supply.—The matters of water supply and sewage disposal for houses unconnected with a city system have been discussed. Some private plants are more costly than many people can afford. However, it costs little to supply running water at one, two, or three outlets and to conduct the waste water from the house. Sometimes there is a never-failing spring from which a pipe may be carried down hill to the house. The waste water should be carried so far from the house that it cannot be a cause of dampness, unsightliness, or pollution of any source of water supply.

Heating coils and a hot-water storage tank (a boiler or a vinegar barrel), may then be secured and are not a great additional expense.



Courtesy Bureau of Home Economics, U. S. D. A.

FIG. 166.—Plan, sections, and view of a farm house for a family with five children. The sections show how the bed in one room is over one in an adjoining room. Note the closet arrangements, the drop tables under the windows of the smaller bedrooms, and the high windows which light the hall and help to light and ventilate the living room.

It seems that this much any house should have to avoid the heavy lifting which is dangerous for the women and children who in the house without a supply of running water have most of it to do, and to insure the cleanliness which is necessary for health.

Sanitary Out-door Toilet.—The usual in-door toilet cannot be had without some system of sewage disposal. The necessity of using an out-door toilet in cold weather is bad for old persons, little children, and invalids. The chemical in-door toilet may be used in such cases. The out-door toilet must be placed at some distance from the house and at least one hundred feet from any well or other source of water supply. The structure must be well built with a tight door provided with a spring or weighted cord to keep it closed, and with a screened opening for ventilation above the door or on one side. The entire seat as well as the cover over the hole should be painted with a glossy water-proof enamel paint that may easily be kept clean. The floor should be smooth and tight. A small ventilating pipe should run up in a corner from below the seat level, and extend a short distance above the roof level. This, too, should be screened to prevent flies getting into the waste matter. The excavation should be well braced to prevent caving in of the sides.

Light and Power.—In the average village and city house we have electricity from the city current and water from the city mains. The electricity is used for lighting, and both water and electricity may be used as sources of power for lightening the house work. If the farm home is to make use of power for labor-saving devices and for light, unless it is close enough to a transmission line from which power may be secured, an independent source of power must be installed. There are several ways by which this may be done. First of all and probably the least expensive is the harnessing of a small stream, having the original power for the dynamo furnished by a water-wheel. This, of course, cannot be employed in many cases because only a few farms are located sufficiently close to a dependable stream. Next to be considered is the gasoline engine. This is in very common use to do the heavier chores about the farm, but if power and light are to be furnished the house, dynamos and motors must be added. There are on the market to-day very convenient lighting systems. These consist of a combination of a gasoline motor and dynamo which generates a current either directly onto a power line or into a storage battery to be used when the motor is not operating. With such a system installed in the basement or preferably in a small out-house built for the purpose, light can be furnished to all parts of the house, as well as to the barns and other buildings, and with the current in the house the farmer's wife may have all the labor-saving devices which the woman in the city has. A one-sixth horse-power motor used for such devices will also operate an electric water pump and pressure system. The installation of such a system is discussed briefly in the chapter on lighting.

Survey of Farm Homes.—In *The Farm Woman's Problem*, by Florence E. Ward, a report of a survey of farm home conditions conducted by the United States Department of Agriculture during the summer of 1918, it is stated that the five outstanding problems of the farm home are:

(1) "Shortening the working day of the average farm woman.

(2) Lessening the amount of heavy manual labor she now performs.

(3) Bringing about higher standards of comfort and beauty for the farm home.

(4) Safeguarding the health of the farm family, and especially the health of the mother and growing child.

(5) Developing and introducing money-yielding home industries where necessary in order to make needed home improvements."

The report goes on to say, "These problems may most speedily be solved by:

(1) Introducing improved home equipment, principal among which are running water and power machinery, and adopting more efficient methods of household management, including the rearrangement of the inconvenient kitchen and the installation of a modern heating system for the whole house.

(2) Helping the farm people to understand and apply the laws of nutrition and hygiene through home demonstrations in child-care and feeding and food selection for the family, and through training in the essentials of home nursing and the installation of sanitary improvements.

(3) Cultivating the idea that investment in the comfort, beauty, health, and efficiency of the farm home and rural community is a wise and legitimate expenditure and perhaps the only means of stopping the drift of young people to the city."

It will be seen that the farm house and its equipment are intimately connected with the first four problems and with all three of the solutions suggested and that improvement of the farm house is considered necessary.

It is the consensus of opinion of economists that from sixteen to twenty per cent. of the working-man's income is expended for rent and from four to six per cent. for fuel and light. How many farm families expend from twenty to twenty-six per cent. of their income for shelter? The rent of a farm house is difficult to determine because it is usually included in the rent of the farm, or when rented separately it is as a rule very cheap because there is little demand for such houses. Fuel in the country very often may be had for cutting and hauling. Food and clothing for the farm family usually cost less than for the city family, while medical attention and some forms of recreation cost more in the country because of the distance to centres where these may be obtained. Because of these differences it is not quite fair to compare the relative expenditures of a town family with those of a farm family. There is a generally prevalent idea, however, that farm houses are inferior to town houses of families of equal means, whether this be true or not there is evident need for improvement of rural homes.

Subsistence Farmsteads.—As part of the National Recovery Program the Federal Government advocates the provision of homes for city workers on plots of ground upon which they may raise some of their own foodstuffs by means of a garden, some fruit trees, chickens, and rabbits. It is intended that this production of food shall be for home use only and to eke out a low wage. The houses for such farmlets must be of the lowest possible cost which will provide the comforts and conveniences of the city, provision for laundry work, and arrangements suitable for rural living. To keep the cost down each room must be planned to hold only the essential furnishings in the minimum of space, except in the case of one general living room, and hall space must be eliminated as far as possible. As a rule, the one story house proves the cheapest. In many of the plans submitted for these houses we find one room in which are located the living, dining, and kitchen areas, a combined laundry and washroom, and bedrooms which are smaller in size than those permitted by most building codes. These bedrooms are large enough if ventilation is provided for by opening the windows. In Fig. 166 is given a view, a section, and the plan of a house designed for a family with five children. The section shows the arrangement of a bed in one room which must be reached by climbing over a low bed in another room. This arrangement saves space as a double-decker bed would, yet gives each individual a separate bedroom which is, however, below standard in size. The floor area of the hall is large compared with that of the whole house. At one end of the kitchen is the laundry which is also the rear entrance where dirty shoes may be changed. There is a heater on the ground floor and a fuel storage room. Food storage space is lacking although home-grown vegetables, fruits, and eggs must be carefully stored if they are to be preserved for more than a very limited time. The wage earner on a subsistence farm must have transportation to the city or to the site of his work. When public transportation is not available he must have a car and a garage.

PROBLEMS

1. How many farm families do you know who have moved to town? In how many cases do you suppose improving the farm house would have kept the family there?
2. Take the plan of any farm house you or one of your friends may know, criticise it as to plan and equipment and make a plan to show how it might be improved.
3. Does environment have a greater influence on the family life of the city family or on that of the farm family? Why?
4. If you know farm families who have moved to town how does the farm house compare with the city house? If you know farmers who live

in the city part of the year or whose families live there part of the year how do the farm house and city house compare?

5. Plan a farm house, two rooms to be built first, three to be added in two or three years, and two more to be added still later.
*6. Lay tracing paper over your house plans and study the changes which would be required to be made in them in order to produce plans for a convenient and comfortable home for a farm family.

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* The starred problem is one of a connected set running through the book.

In some localities there is a decided objection to the double or group house, perhaps because of the bad impression given by the old-fashioned row. Modern group houses are altogether different affairs; the grouping and the designs are carefully made to insure variety and individuality for each dwelling, yet to make an harmonious whole. With groups of from four to six units the architect has a splendid opportunity, for their size and the special requirements of grouped houses offer better opportunities for design than does the single house (Fig. 169). In planning each house in a group the same rules hold good as for planning a single house, and there are certain additional rules which must be given

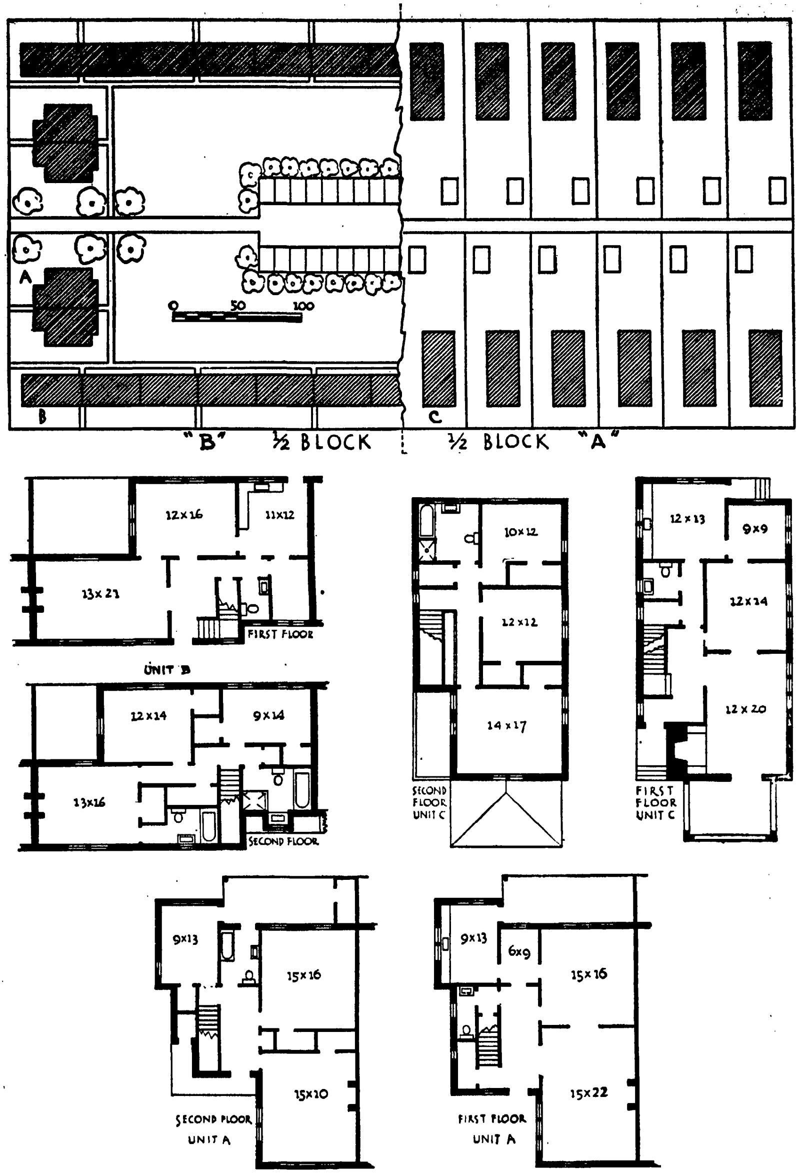


FIG. 167.—Two plans for the utilization of a city block: "A," the usual division into lots, each with a single detached house; "B," an arrangement of group houses with a garage court in the center. Plans shown for Unit A are for half the double house. Plans shown for Unit B are for a typical inside unit in the rows. Plans shown for Unit C are for a characteristic detached house.

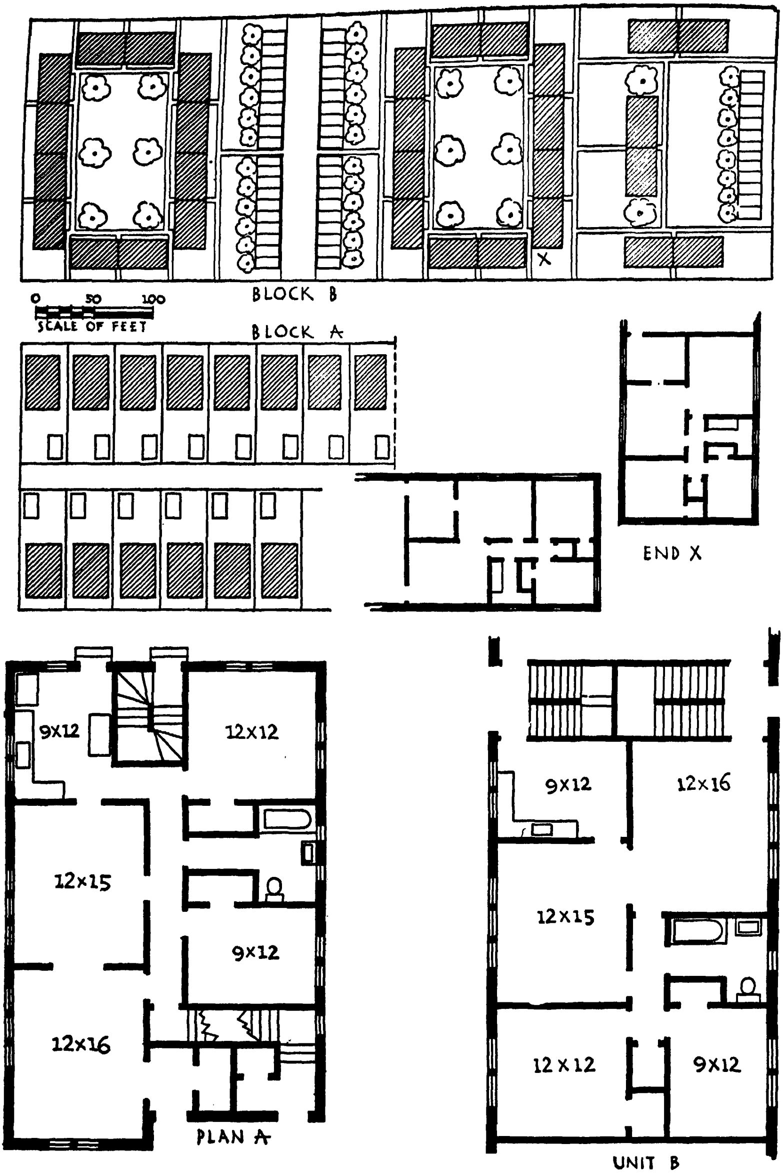


FIG. 167a.—Two plans for the utilization of a city block: Block A, the usual division into lots on each of which is a two-family flat-house; Block B, flats arranged in rows. Plan A is for the detached flat-house; Unit B plan, for the inside units in the rows; End X plan shows the arrangement of the end units.

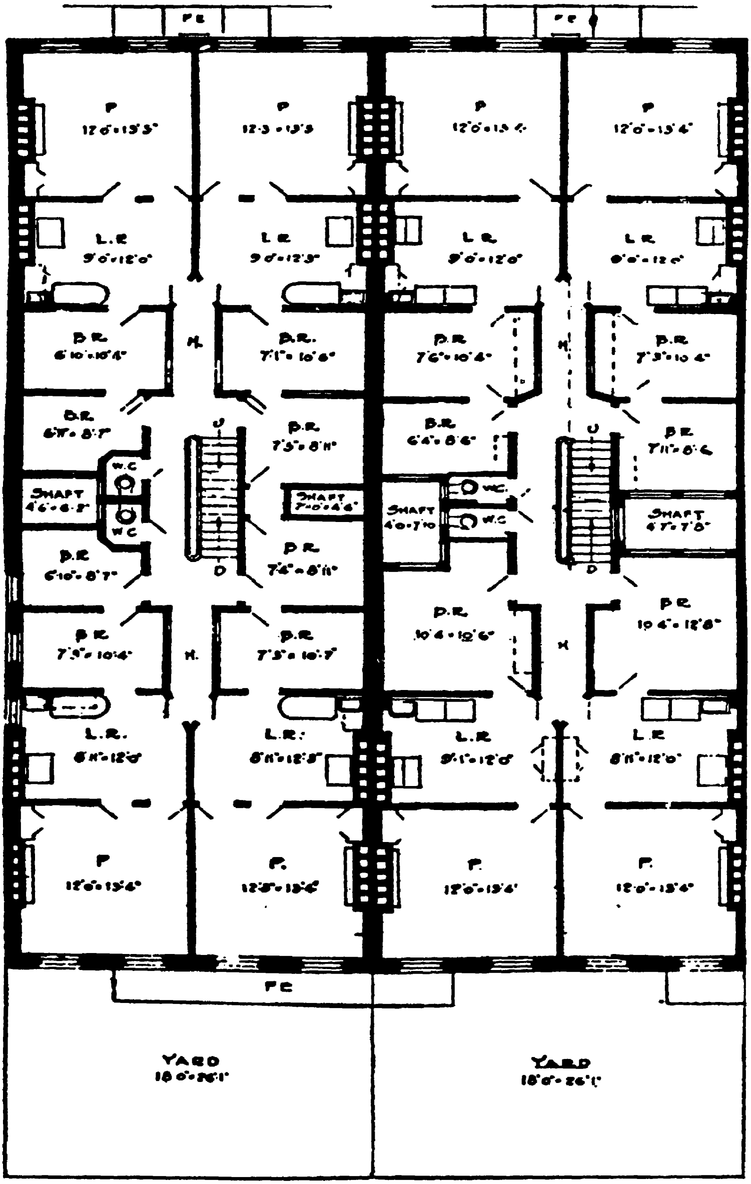


Fig. 168.—"Old Law" tenements. Eighty-five per cent of the lot is occupied. It should be noted that some rooms have no windows, others windows on very small light courts, and that two toilets serve four flats,

careful attention. Although two or more families are under the same roof the privacy of each must be preserved; this means special care in planning, and sound-proof walls between houses. For this reason it is well to have the entrances, both front and rear, to the different units separated from each other. It is important that good ventilation and plenty of sunshine are insured to each unit. In order to make the most of the opportunity for the exercise of economy, flues should be concentrated in as few chimneys as possible and plumbing fixtures should be grouped in order that the same main supply pipe and soil pipe may do for two sets of fixtures.

The Double House.—The double house is one of a pair with a party wall between and usually the plan of one house is the plan of the other reversed. With this arrangement it frequently happens that one house has a very desirable exposure and outlook and the other does not. In other cases it is possible to have these advantages for both, in which case the double house is satisfactory.

Two-Family Flats.—A compromise between the single house and the apartment is one whole floor in a two or two and one-half story detached building. A building of this kind may be called a duplex, a St. Louis apartment, or a two-family flat. The first floor is one apartment, the second floor a second one, and sometimes both apartments have rooms on the third floor. Usually the basement is divided and there are two furnaces and two laundries, but frequently the owner lives in one apartment and furnishes heat for the one which he rents, and the laundry may be shared by the two families living in the house. Each flat has its separate front entrance and back door. Such a dwelling as this, surrounded by a plot of land where each family may have its own garden, lawn, and playground for the children, while not as desirable in some respects as a separate house, or a home in a group house, has the advantage of being a little cheaper than the individual house. It is especially desirable that the upper flat have a porch in order that the people living in it may get out of doors easily.

Row Houses.—When a house, either a single family dwelling, a duplex, or a flat-building, is built on the usual city lot, it must be long and narrow and the margin of the lot left on either side is small. Since the side windows of one house look into those of adjacent houses, privacy is to a certain extent lacking and, furthermore, the side rooms are neither well lighted nor well ventilated. Row houses, when only two rooms deep, are superior to single family houses crowded together. In rows more than two rooms deep, however, the middle rooms can, at best, have windows only on narrow courts.

In Fig. 167, the advantages of the single family row house are shown as compared with the detached house. Two block plans are shown, one divided into lots fifty feet wide and one hundred and fifty feet deep with an alley twenty feet wide between the two rows of lots. This arrangement gives twenty-four houses on twenty-four lots. The other block plan shows thirty-four row houses, each with a broad frontage and an abundance of light and air. Twelve of these are end houses and have windows on three sides. The garages are grouped together in a garage court in the center of the block screened from view by their end walls and suitable plantings. It should be noted that there are the same number of rooms in the row house as in the detached house, that the floor areas of the principal rooms are greater, and that the space is better arranged in the row than in the detached house. Thus we find over 40 per cent more dwelling places with better outlook, ventilation, light, and arrangement in the row of houses.

In Fig. 167a is illustrated a typical block development of thirty-two crowded detached duplexes, each on a lot thirty-seven and one-half by one hundred feet, together with a development of the same ground area, whereby thirty well lighted duplexes in rows are obtained. This is two less than the number of detached duplexes, but the economies effected by building in rows would be sufficient to offset the rent of two units even if the rents of the detached duplexes and those of the row ones were the same, whereas the greater attractiveness of the row apartments would make them more easily rentable.

In the case of the single family houses and in that of the duplexes, a large capital is required for a block development. What happens ordinarily is that a block is parceled out in lots, each of which goes to a different contractor or home owner. Thus money is wasted and opportunity is lost through each building independently on his own lot.

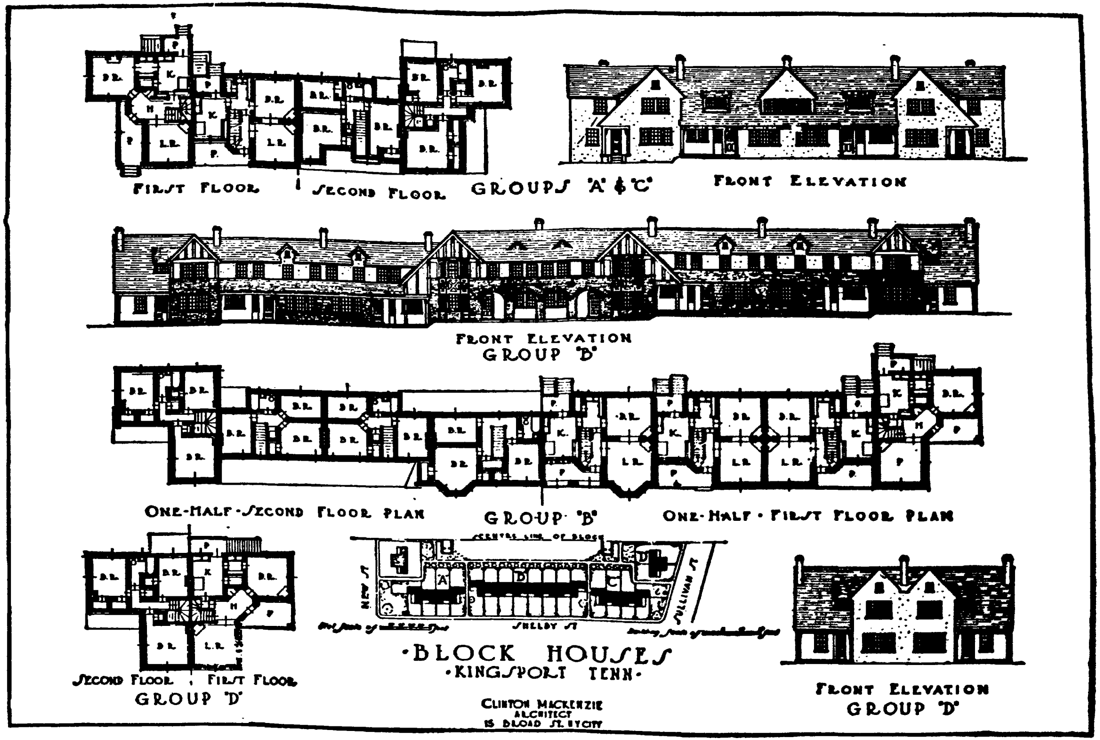


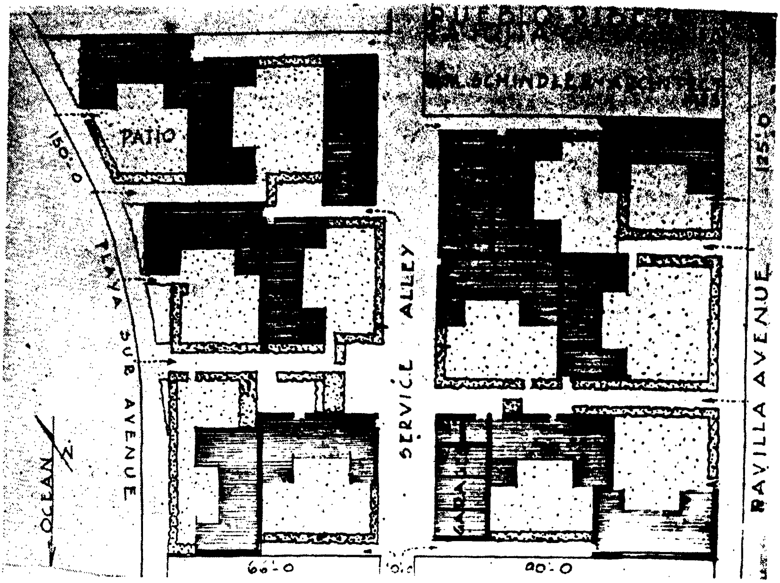
Fig. 169.—Plans and elevations for group houses. Blocks A and C consist of four houses each, Block B of eight houses and Block D of two houses. There are only two different plans of the individual houses used in these groups.

One of the objections to houses in a row is that they are monotonous and ugly. The well-designed row need not be ugly; indeed, there is more likelihood of obtaining beauty in a row of ten or twelve low-priced houses than in a line of eight or ten small cottages which, on narrow lots, must be narrow and two stories high and therefore do not have pleasing proportions (Figs. 169 and 185).

Bungalow Courts.—One solution of the problem of housing small families at a low cost, compared to that of the usual single house, is the bungalow court. The bungalow court comprises several detached, semi-detached, or row houses built about a central open area one end of which abuts upon the street. The landlord cares for the grounds and may provide some services. The garages are grouped at the end of the lot. There are courts of various degrees of desirability and at various rentals. Some miserable courts of eight to ten units are built on lots fifty feet by one hundred. As a general thing even in the better courts there is a lack of privacy, for sounds from one unit are easily heard in the neighboring ones and the different units look into each other's front or side windows. That this lack of privacy is unnecessary may be seen by Fig. 170, which shows how twelve units and twelve garages are located on one irregular piece of ground one hundred and twenty-five feet wide and one hundred and sixty-six feet long on one side and two hundred feet long on the other. Here each unit is completely isolated from the others with regard to view and reasonably so as to sound. A view and the plans of these units are given in Figs. 170a and 170b.

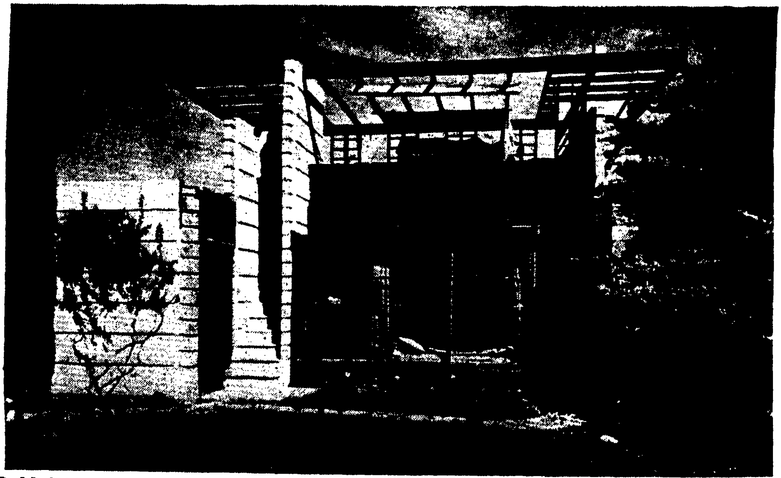
In the group houses discussed each dwelling has its own street entrance; in apartment houses the dwellings are entered from a public hall which leads to a common street entrance. Technically such a building is a tenement house but in common parlance this term is restricted to an inferior class of building and apartment house is used to designate the better class.

Apartments.—A modern well-planned apartment house is so arranged that many of the apartments have windows on three or even four sides and only a few of the smallest have windows on less than two. The best apartment buildings are those which leave enough of the ground area vacant to provide the tenants with



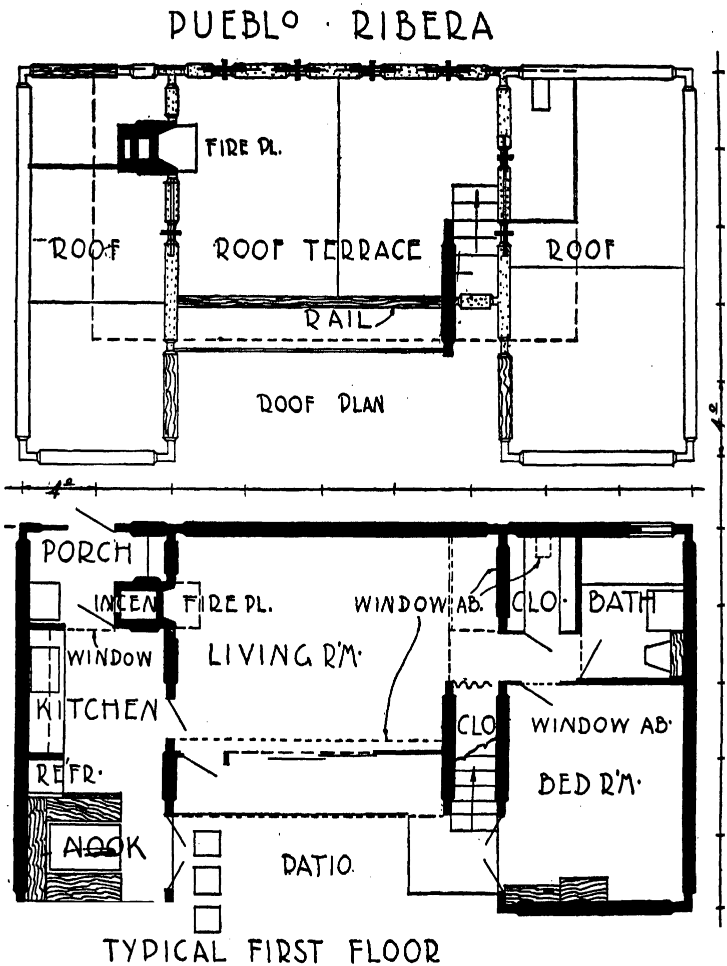
R. M. Schindler, Architect.

Fig. 170.—"Pueblo Ribera." Layout showing how a small lot can be built up densely without the usual disadvantages. The same house is repeated twelve times. However, the units are arranged in such a way that interesting groups are formed, avoiding monotony, and that each house has a private patio not overlooked by any of the neighbors' windows.



R. M. Schindler, Architect.

Fig. 170a.—View of a concrete house with a roof garden. One of the units in the group shown in Fig. 170.



R. M. Schindler, Architect.

FIG. 170b.—Plans of one of the units in the group shown in Fig. 170.

sunshine, ventilation, and a pleasant outlook upon a parked area. Some apartment houses admit children and provide play-space for them on the ground or on the roof. An apartment with ample light, air, and play-space makes a suitable home for children when the mother devotes sufficient time to keeping them out-of-doors, although it is not so desirable as the detached house and yard between which the children may run back and forth at will. An apartment house which admits children must be so planned and built that the disturbances unavoidably created by the children of one family will have the minimum effect upon other tenants.

Most apartment houses are not built for the accommodation of children and are suitable only for adults. The great attraction of the high-grade apartment house is due to its convenience, the relief from responsibility, and the services which can be secured for less money in the apartment than in the house because the apartment house is, in a way, a coöperative scheme. The persons whose needs an apartment house serves are those who have not the time nor the strength to keep up a house. A man and wife both of whom work; a man with a wife not strong enough to care for a house, and who cannot have help; elderly women; those who are employed and want to escape the boarding house or hotel and to have not only latch keys but their own front doors; men who also want places of their own; and, in fact, any group with no growing children may be suitably housed in an apartment house.

We see very many examples of poorly planned, unsanitary, dark, and gloomy apartment houses just as we see examples of the same faults in houses, and such defects are as inexcusable, as injurious, and as wasteful in one as in the other.

The rules for planning the house apply to the apartment as well. Whenever it is possible, it is well to have a porch for each apartment. As a rule, apartment house dwellers do less cooking than families in houses, and usually they are closer to markets, groceries, bakeries, and delicatessen shops; therefore in the apartment house less space for food storage is required than in the house. Gas or electricity is used for fuel and no fuel storage is needed, and therefore in apartments we frequently find the kitchenette, a small space of from twenty to fifty square feet (Fig. 26). The arrangement of equipment should be as carefully thought out as for larger kitchens, and the lighting and ventilation must be considered. A ventilator into a flue is often used in kitchenettes.

The tendency to limit the area of the apartment and of the house by the use of devices which fold up out of the way, or which convert one article of furniture into another, has developed from the increased cost of material and labor and the consequent limiting of the floor space of our homes. How far the use of such contrivances is advisable is a question.

Cheap construction should never be permitted in apartment houses. It is important, in order to secure adequate privacy, that the walls between apartments, the hall walls, and the floors be sound-proof. Every apartment house should be of fire-proof construction, that is, there should be no wood about it except the doors, door and window frames, and the finished flooring; or, at the very least, it should be of slow-burning construction and well provided with fire escapes. Fire escapes are to a building what life boats are to a ship.

Tenements.—The fact that the building of many flats on a small plot of ground, one over the other, under one roof, requires an investment less than that for building an equal number of single dwellings has led to the crowding together of the poor into tenement houses, the individual flats of which lack the conveniences of the high-class apartment. Many tenement houses are not only lacking in comforts but they are positively injurious because of the fact that most of them have been built to return a large profit for the lowest possible rent, and sanitation, or the providing of a favorable environment for maintaining the health of the occupants, has been neglected. The plan of such a tenement house is shown in Fig. 168. The rooms in such places as this may be rented singly or two or more together. Other arrangements exist in which several rooms without windows open one from the other and, since they do not open on a hall, one must pass through several rooms to reach the innermost one. Since 1901, New York City has forbidden the construction of a windowless room in any tenement house and has enforced the cutting of windows in dark rooms, of which there were 350,000 when the law was passed. When nothing else was possible the window was cut into the wall between a day-lighted room and the dark one.

In some of the earlier tenement houses the water-closets were all in the yard or in the basement, and the only water supply was in the yard. This condition likewise has been remedied in many places. Nevertheless it is estimated that two million persons in New York are living, in 1934, in "Old Law" tenements. It is hoped that this condition will be ameliorated by the new housing projects undertaken by the city with Federal aid.

The fact that the very worst conditions are prohibited by law in most large cities does not mean that the tenement-house problem has been solved. Many of these injurious buildings are occupied, frequently by large families crowded into three or four rooms. Children have no place but the street in which to play. Social workers realize the necessity of getting people into the right kind of living quarters, but as fast as one family is moved from unsanitary surroundings another takes its place. In many places the laws we have are insufficient, yet actual conditions fall far below the standards they set. Chicago, for instance, has since 1910 stipulated that the minimum room-size in any apartment shall be eighty square feet floor area and that one room in every apartment shall have one hundred and twenty square feet floor area, yet many of the older apartments fall short of this, for a building once up will last fifty years at least, unless it is burned or demolished. It is a costly proceeding to pull down blocks of houses, but European cities have had to do it, and America is coming to it. How much better it would be if we had prevented the erection of these unsuitable dwellings! Every city should take steps by city planning and by zoning or districting to halt the tenement district, and by housing laws to require every new construction to meet the best standards of sanitation known.

Slums.—A slum is defined as a "low filthy quarter of a city or town." Tenement houses are as a rule in slum districts but a slum need not contain tenements. In cities and in towns, when a house, once perhaps the best, the stateliest, and most modern of the day, ceases to answer the requirements of the owners they, if they can, build anew. They get away from encroaching business houses or factories, from disintegrating floors and walls, or antiquated plumbing, and sooner or later the old mansion shelters several families. What was bad for one family is worse for several. All must use the same toilet, no one has any special interest in caring for the public halls, and the various rooms are not adapted to the purposes for which they must be used. Almost every town, no matter how small, has an old house or houses with a history like this. This condition might be controlled by laws as to the use of houses, but a better way to remedy their degradation and wrong use is by city planning and zoning which will largely prevent these common changes in the character of neighborhoods. We must wake up to the fact that slums, wherever found, hinder progress and defy our American traditions and ideals. It is estimated that thirty million people, nearly one-fourth of the population of the United States, are living in slums.

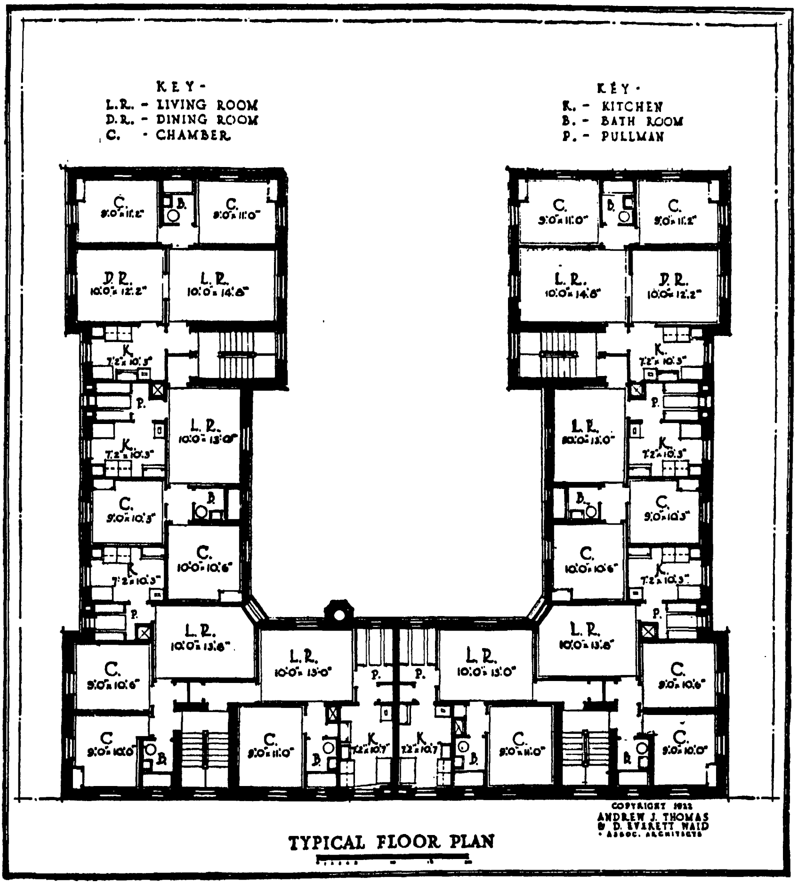


Fig. 171.—Typical floor plan for the Metropolitan Life Insurance Company's housing development in Long Island City. The block plan in which this unit is used is shown in Fig. 182.

New buildings as a rule are provided only for those portions of the population on the higher income levels. Little has been done to provide decent houses for those on the lower levels and these people, except when they live in tenements, inhabit the cast-off dwellings of the more fortunate. Careful planning and wholesale building will provide well-arranged, well-lighted, and ventilated apartments rather than tenements, at a rent no higher than is paid for the congested tenements, as is evidenced by the housing development of the Metropolitan Life Insurance Company, plans of one unit of which are shown in Fig. 171. The rents of these apartments need be no higher than tenement rents, and still yield a satisfactory return on the investment.

Effect of Bad Housing on the Whole Population.—The proper housing of those who live in the cheapest dwellings is a matter which affects us all. While the health and morals of a family are largely affected by the house it occupies, the effect extends beyond this particular family, for the welfare of the entire community is affected by the conditions of each of its members. Verily, "No man liveth to himself and no man dieth to himself." If unsanitary conditions are permitted or necessitated in the dwellings of the poor, they lead to sickness and death. Indecent crowding leads to vice and crime. These evils will prevail not only in the crowded community in which they originate but will spread to the homes of the more fortunate who already have their own peculiar sources of evil to contend with. The housing of the poor is a community problem. The cost to the community of disease, vice, and crime in broken lives, in the upkeep of police and prisons, social workers and health agencies, is very great. Much of this cost may be charged to improper housing, the money profits of which are reaped by a few greedy individuals while society at large not only pays a money price in taxes for corrective measures but suffers, as has been indicated, from the contagion of those disorders, physical and moral, which have their origin in crowded and unsanitary neighborhoods. The whole of our democratic system is endangered by those who have suffered because democracy has failed in certain ways. Frederick Law Olmstead says, "The country must come to recognize the house problem as a national problem of the most vital importance to the security of our democracy." Since the housing problem is a community problem we must, as communities, learn that it is as wrong to injure human beings by bad living conditions as by poison, that social problems are interwoven with the housing problem, and that ignorance of what is going on around us is dangerous, while neglect of the proper precautions and remedies is criminal.

It is the general opinion that the tenement house as we know it today must go, not only on the grounds of hygiene and social welfare but on economic grounds as well. The vast housing projects of the Federal Government will no doubt greatly hasten the attainment of this much-to-be-desired objective.

Necessity for Constructive Housing Programs.—Since the earlier part of this century there has been a great falling off in the rate of building of all classes of dwellings, with a consequent crowding together of families, two or more frequently occupying quarters designed for one, or living in a two- or three-family house built on a lot planned for a single detached house. The shortage of houses is due to the rising cost of building and diminishing returns on the money so invested. The World War probably only hastened the acute stage of the housing problem to which we had been slowly drifting before. Since the war and before 1930 there was much building, but too often the houses were cheaply built and very poorly planned. The matter of providing shelter has until recently been left, with certain restrictions and provisos, to the individuals who build their own homes or who build to sell or to rent, but it has long been evident that private initiative under present conditions can no longer meet all the requirements of the situation. Besides the building laws and the tenement house laws with which we are more or less familiar we must formulate some plan which will promote the building of desirable dwellings not only for the very poor but for all but those with the highest incomes; in other words, we must have a constructive housing program. The first step in such a program is the establishment of desirable and reasonable standards for the house of the workingman; the second is the finding of means for attaining such standards. These matters are discussed in the following chapters.

PROBLEMS

1. What types of the multiple house are found in your town?
2. Find an example of a slum dwelling. What is its history?
3. What organizations are there in your town which are working toward housing betterment?

CHAPTER XIX

THE STANDARD HOUSE

> "A large part of the evils of which we complain socially today are due to the kind of houses we live in and the exactions they make upon us."—Wells.

About the middle of the last century there began to be an active interest in housing conditions in the great cities because of the attention focused upon the unsanitary and dangerous buildings into which the poor were crowded. Tenement house laws were passed to bring about changes in these conditions and new laws have superseded old ones as the latter were found inadequate. We also have building laws applying to the construction and upkeep of the detached house as well as of the multiple dwelling. Students of the housing problem consider our present laws inadequate and have drawn up standards which they believe should govern all new construction, and they tell us we need two sets of housing standards, the first applying to the site and construction of the house, the second to its use, for a house in itself may be perfectly good and yet it may be used in such a way as to make it a source of danger to its occupants and the neighborhood. It is generally considered that each individual requires from seven hundred to eight hundred cubic feet of air space in bedrooms. A bedroom of eighty square feet of floor area would meet this requirement for one person, yet in the three- and four-room apartments, which are more numerous than the sum of apartments of all other sizes, such a bedroom often holds two beds, with two occupants each. In small houses we find the same condition, two or more people sleeping in a room large enough for one person only. This is an example of a wrong use of the house, or room crowding. It is not enough to specify the cubic feet of air for bedrooms. A room with a good window on a wide street may safely be the bedroom for two adults even if it is less than eighty square feet in area, if the window is opened and there is good ventilation about the house, but a room double this size with open window is undesirable if the room is on an air shaft or court where there is little change of air. While it is difficult to control such matters as this, restrictions have been devised which help to do so.

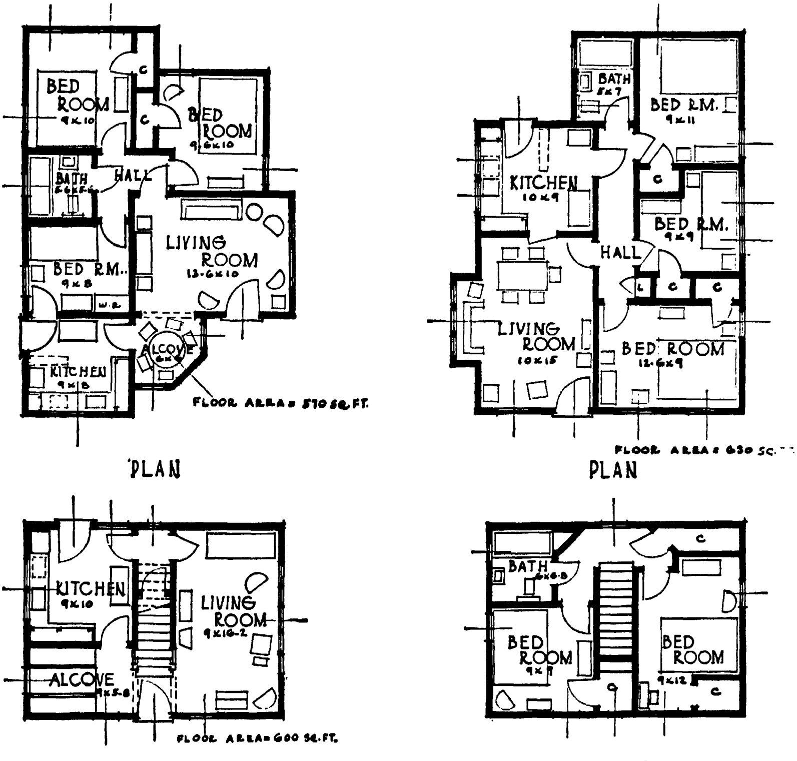


FIG. 172.—Bungalows and a two-story house for five persons in accord with the standards set for the health and decency level of living. Lawrence Veiller in his Model Housing Law gave the patterns upon which most of our laws are based. It covers the relation of the house to the lot, its plans, construction, and use.

Standards for the Health and Decency Level of Living.—In 1920, the U. S. Department of Labor set up minimum housing requirements for a family of five living at the health and decency level. These provide for a minimum of one room per person and in addition a bathroom. The rooms may be two bedrooms, living room, dining room, and kitchen, or three bedrooms, kitchen and one other room. The floor area of the house including bathroom, closets, and hallway is fixed at approximately 660 square feet. A family of four would be equally well accommodated in four rooms of 528 square feet area; a family of three in three rooms of 396 square feet area; and a family of two in two rooms, a kitchen and a combined living room and bedroom, of 264 square feet area.

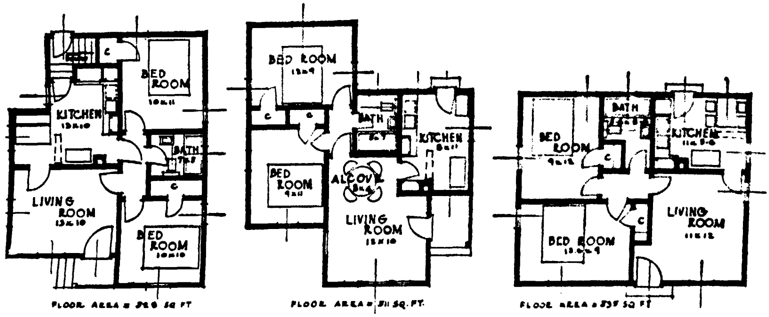


Fig. 172a.—Plans of houses for families of four in accord with the standards set for the health and decency level of living. One of these, with slight changes, might be used for a double house, the two others for houses in rows.

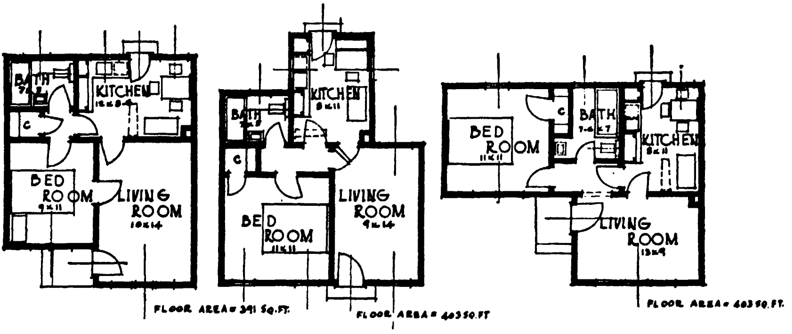
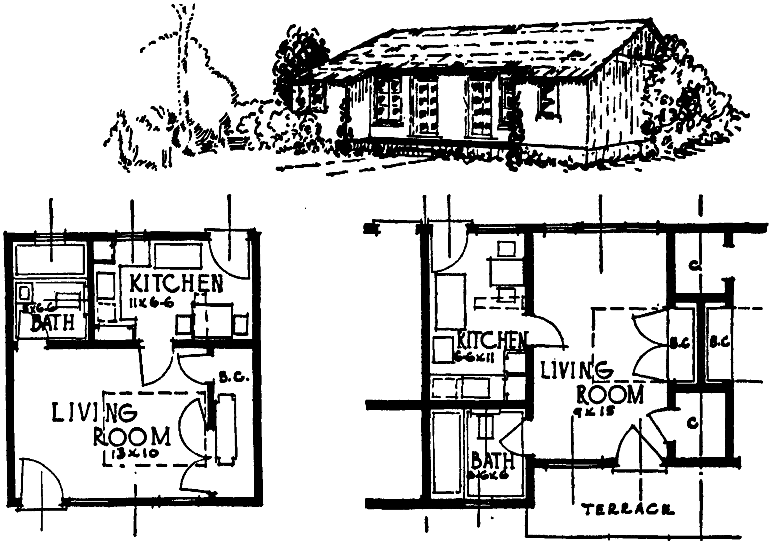


Fig. 172b.—Plans of houses for families of three in accord with the standards set for the health and decency level of living. These houses are planned for units in rows.

Types of houses which meet these requirements at the least cost are illustrated in Figs. 173 and 174. More attractive and convenient are the plans shown in Figs. 172 and 175, which would, however, cost more to build. Certain of these plans would not be suitable in cold climates unless gas were available for heating.

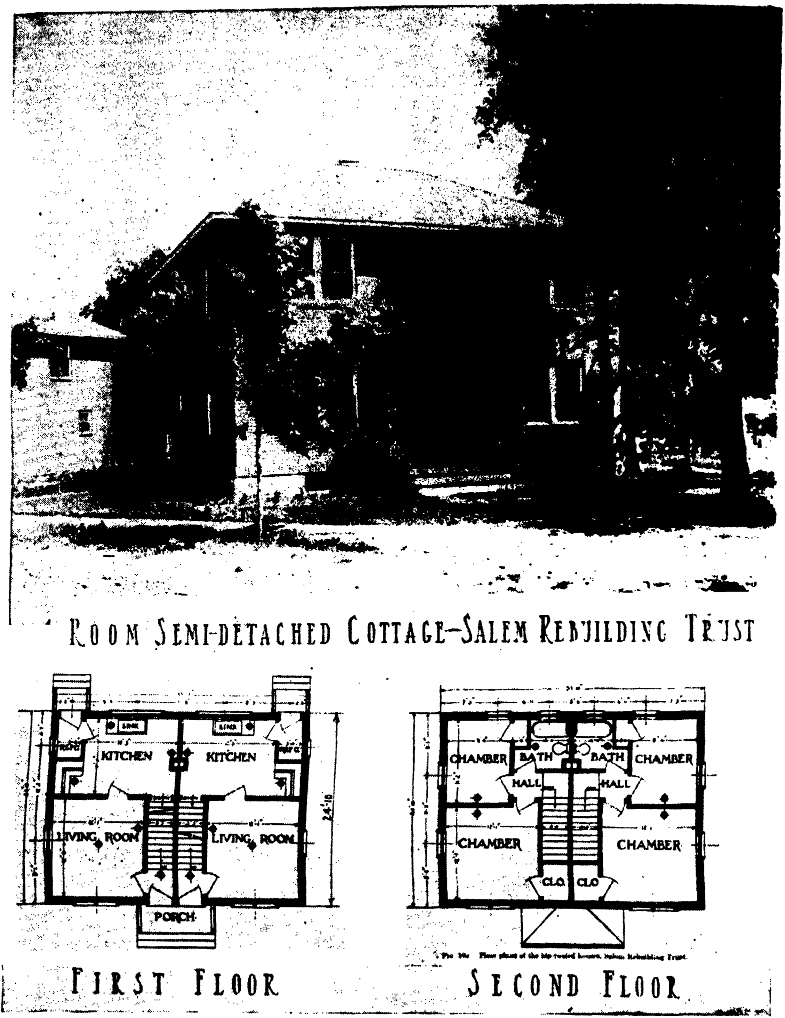
The plans in Figs. 172b and 172c for two- and for three-room dwellings are not suitable for detached houses for the lot would cost too much in proportion to the house. They might be units in a bungalow court or in an apartment house where the heat would be furnished by a central heating system and included in the rent.

Standards for Higher Economic Levels.—Life is more attractive when we live in better houses than those illustrated for the health and decency level of living, and better homes afford opportunity for a larger personal development; therefore the standards for more expensive houses should be higher than those outlined above. The majority of authorities suggest that not more than from four to twelve of these better houses should be built on one acre, the lower number being for the rural village without a sewerage system. Twelve houses to the acre, however, means a very small lot, about thirty-five feet by one hundred feet. Only group houses are suitable on such small lots, for the least distance which should be allowed between houses is said to be the distance from the ground to the eaves. This would be from ten feet for low one-story houses to twenty feet or more for two-story houses—on the whole, a wider lot than that assigned to the house in the past. Larger rooms are advocated than those possible in the house for



FLOOR AREA = 264 SQ. FT. FLOOR AREA = 273 SQ. FT.

FIG. 172c.—Plans of dwellings for families of two in accord with the standards set for the health and decency level of living; sketch showing two houses built in a row from one of these plans.

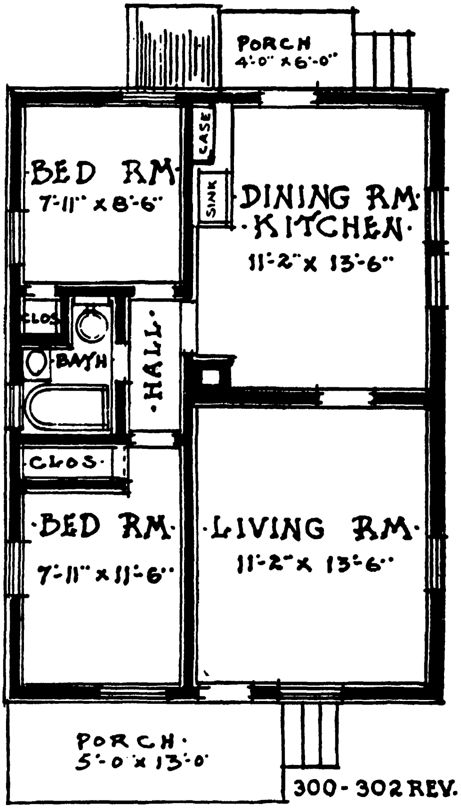


Courtesy *Low Cost Cottage Construction in America,* Harvard University.

FIG. 173.—Plans and elevation for a house of four rooms and bath, built by the Salem Rebuilding Trust. This house sold for $1,791 in 1915.

the family living at the level of health and decency, and more rooms per person. It is considered desirable that each member of the family have his own room. The point is repeatedly stressed that outlook, sunshine, and ventilation are to be considered in arranging rooms.

For certain housing developments, government financial aid has been granted contingent upon following certain standards. At the end of this chapter are given two such sets of standards as well as the standards advocated by Raymond Unwin for the English house.

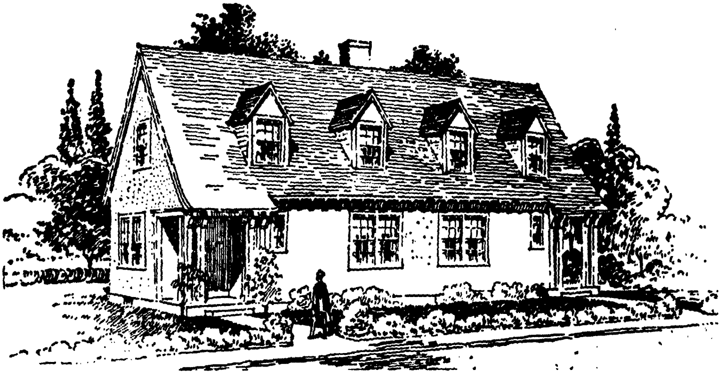


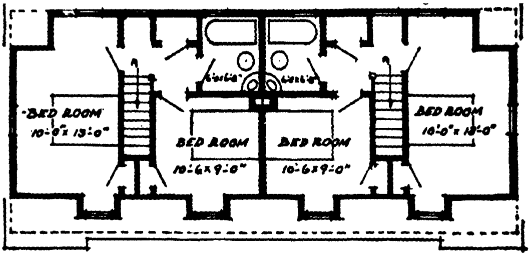
COTTAGE No. 302

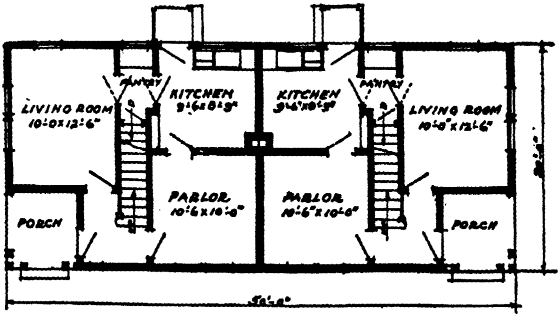
Courtesy *Low Cost Cottage Construction in America*, Harvard University.

FIG. 174.—Plan of a cottage of four rooms and bath, built by the Albany Home Building Company, Albany, New York, and sold for $1,900 in 1912.

There are many variations in the housing standards recommended and accepted. Houses built to conform to some of them have not given satisfaction: for instance, a ceiling height of eight feet over two-thirds of the area of bedrooms and sloping to side walls five feet high has been a cause of complaint in Leicester, England. While our standards may be mistaken, it is still well that we formulate them and that the nation, the city, and the town fix fitting criteria for the peoples' houses. We must remember that the passage of housing laws can do little to improve conditions unless they are properly enforced, and this means a staff of inspectors to be maintained and the popular support which is necessary for the upholding of any law. The standards embodied in laws are







FIRST FLOOR PLAN

TWO FAMILY - FIVE ROOM HOUSE

Fig. 175.—Plans and sketch for a double house of five rooms each. The arrangement of the ground floor is very good in that either the parlor or the living room may be used as a bedroom by a family needing more than two bedrooms. The design of the exterior is good.

usually somewhat behind those advocated by the foremost thinkers because of the fact that law must have popular support and because it takes years of agitation to secure this support.

In any housing program there are groups other than the family to be considered. Individuals living in hotels and boarding and rooming houses must be accommodated. Besides the bedrooms and bathrooms for these, there should be recreation or assembly rooms. In Figs. 176 and 177 are shown plans for a house to accommodate a family and boarders. Note that the family may enjoy privacy on the first floor, and that boarders may have rooms on the second floor and need not go through any part of the family's quarters, the only room shared being the dining room.

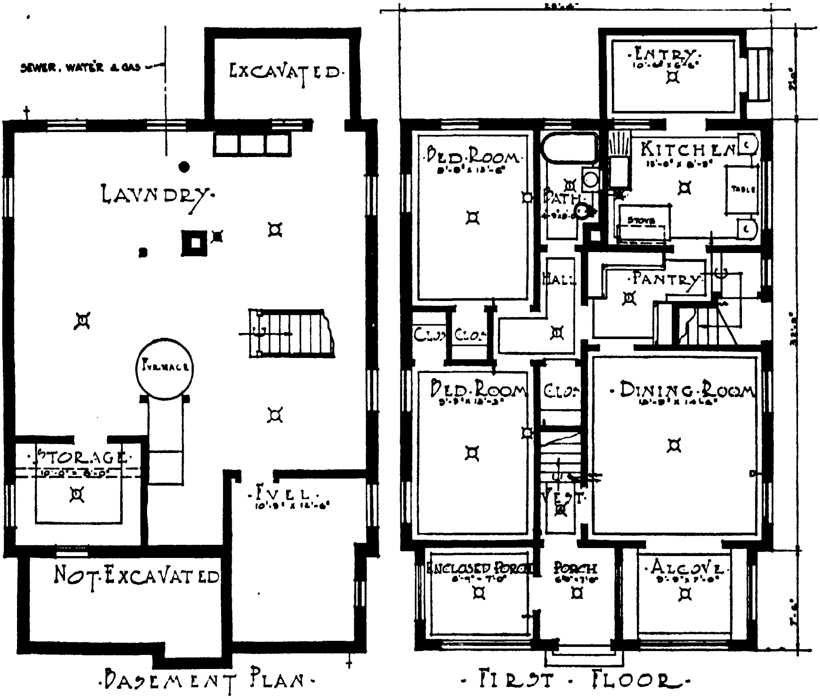


FIG. 176.—Plans for a house arranged for keeping boarders at Morgan Park, Minn., a village of the Minnesota Steel Company. (See also FIG. 177).

In earlier chapters matters pertaining to the site grounds, plans, appearance, heating, lighting, and plumbing have been discussed. The availability of desirable sites conveniently located with regard to other parts of the town, not too costly in relation to the type of dwelling to be built upon them, sanitary, and offering beauty to those who build upon them, depends upon town planning, one of the ways of reducing the cost of shelter.

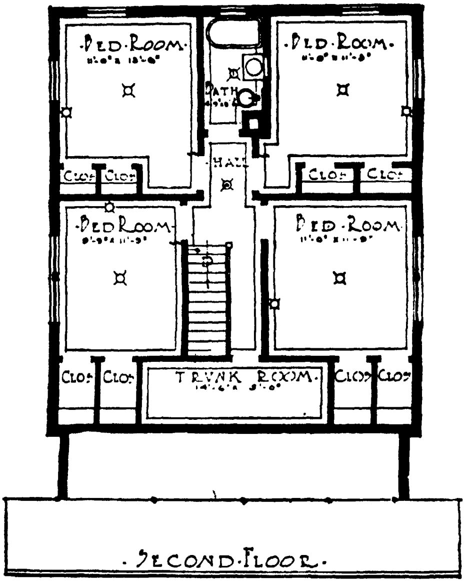


FIG. 177. (See FIG. 176.)

Shelter costs money and in the way that it is furnished us today, it costs more than it should. If better methods of supplying it were employed we might all have better homes than those we live in at present for no greater expenditure. Ways of reducing the cost of shelter are reviewed in the two chapters following this one.

PROBLEMS

1. What housing standards are demanded by law in your community?
2. Draw up a set of standards for the farm house.
3. Select location and plan a house for a group of local women teachers.

SUGGESTED HOUSING STANDARDS

I. U. S. Department of Labor, Bureau of Industrial Housing and Transportation.

These standards, which were recommended for permanent industrial housing developments, as part of the war-housing program (1918), are "not intended as inflexible requirements, but any plans which fail to conform to them are not likely to be accepted unless supported by very strong reasons. Local building codes, housing laws, and similar ordinances are to be followed, provided, however, that in case such local regulations permit or require anything not permitted by these standards the express approval of this bureau is to be obtained before departing from the standards as here outlined."

Types of Houses (principal types only).—Type 1, single-family house; type 2, two-family house; type 3, single-family house with rooms for lodgers or boarders; type 4, lodging house for men; type 5, hotel for men; type 6, lodging house for women; type 7, hotel for women; type 8, tenement house; type 9, boarding house.

I. General Provisions.—All types of houses to conform to these general provisions and, in addition, to certain special provisions as later indicated.

1. Arrangement—Row or group houses normally not to be more than two rooms deep.

2. Basements—No living quarters to be in basements.

3. Closets—Every bedroom to have a clothes closet, opening from the room. Built-in wardrobe dressers will not be accepted. Normally such closet to be not less than 22 inches deep and with door. Closets to be supplied with rods to take coat hangers.

4. Cooking—Gas preferred, but flue for coal stove to be provided; all flues to be lined. The question of whether or not cook stoves are to be provided with the house to be considered at the time materials are being ordered.

5. Fences—Board fences will not be accepted. Hedges or open metal fences desirable. Suitable arrangements for drying clothes to be provided. Where there are open metal fences the fence standards can be designed for this purpose.

6. Furniture Space—Beds to be indicated to scale on plans (double beds, 5 feet by 6 feet 6 inches, single beds, 3 feet by 6 feet 6 inches). Location of beds not to interfere with windows or doors. It is recommended that beds be free standing and not located in a corner or with the side against a wall. Space to be provided for two pieces of furniture in addition to bed. Halls, stairs, and doors to permit easy moving of furniture.

7. Gardens—Allotment gardens, conveniently accessible, preferable to increasing the size of the lot to provide for individual back-yard vegetable gardens.

8. Lighting—Electricity preferred.

9. Materials of Exterior—Materials dependent on local supplies; brick, terra cotta, stone, or concrete preferred. Outer walls to be insulated against dampness and condensation. Rat nogging to be provided. Roof to be fire resisting; leaders and gutters not essential unless drip will do harm.

10. Open Spaces—Side-yard space between adjacent buildings to be preferably 20 feet; minimum, 16 feet; such space to be increased proportionately for each additional story, or part of story, above two stories. If this space is not obtainable because of lot sizes or land values, houses should be built in rows or groups.

Rear-yard depth not to be less than height of building, nor in any case less than 20 feet. Minimum distance between backs of houses to be 50 feet. Consideration to be given as to whether sites should be provided for garages. When not an integral part of the house garages should preferably be at the rear of the lot, should not be located closer than 15 feet to the nearest part of house, and should not exceed one story in height.

Front yards or set-backs desirable where practicable; minimum distance from front of house to front of opposite house to be 50 feet.

Covered porches to be considered part of building.

11. Plumbing—House drain under house and 5 feet outside to be extra heavy cast iron. Vitrified clay pipe, with proper joints, may be used where ordinance permits. It is recommended that soil and waste pipes be extra heavy cast iron or genuine wrought iron. Soil and waste pipes to be extended through roof. A 3-inch soil stack preferred where not more than two water-closets are placed on one stack.

Water-closets to be porcelain and wash-down, siphon, or siphon-jet type, with individual flush tank. Open-front seat recommended. Out-door water-closets will not be accepted. Privies will not be accepted. Cellar water-closets not permitted except where supplementary to accommodations herein required.

Access to water-closet compartments to be from hall or vestibule, never solely from a room. Plunger, pan, long-hopper, and range closets will not be accepted.

Hot and cold water to be provided to all fixtures, with proper drains and shut-offs. Wooden sinks and wash trays will not be accepted.

All fixtures to be separately trapped except in batteries of wash trays and combined sink and wash tray, where one trap is sufficient.

Venting of traps to conform to approved practice, except that the back venting of the top or only fixture on a line is not required. Sink and lavatory traps to be connected direct to the vertical wastes, and not to floor branches. Exposed pipes preferred, and when exposed, wrought iron preferred. Where possible, lines to be concentrated and kept from outside walls.

12. Porches—Desirable. To be of durable construction, particularly the foundations; to be restricted from encroaching on minimum side yard or unduly darkening rooms.

13. Rear Entrances—In case of row or group houses there may be access to the rear through minor one-way public streets. Such streets to be not less than 12 feet wide; to be properly paved, curbed, drained, and lighted. Private alleys will not be accepted.

14. Roof Air Space—In every house there shall be a minimum clear space of 8 inches between the ceiling and the roof; this space to be provided with adequate water-proof openings for ventilation, at both ends if practicable.

15. Rooms, Number of—Bathrooms are not to be counted as rooms.

16. Stairs—Risers to be not more than 8 inches high and treads to be not less than 9 inches wide. Winding stairs will not be accepted except in types 1, 2, and 3. Not more than 2 winders will be allowed in series. Treads must measure at least 9 inches wide 18 inches from rail.

17. Ventilation—Every room to have at least one window opening directly to the outer air. Two windows in each room generally preferred; one window sufficient in small bedrooms. Each room to have a window area of not less than 12 square feet.

Cross-ventilation as direct as possible to be provided for all rooms through windows, transoms, or doors; communicating door recommended between front and rear bedrooms in row houses.

Every bathroom to have window of not less than 6 square feet in area opening directly to the outer air.

Every water-closet compartment to have a window of not less than $4\frac{1}{2}$ square feet in area opening directly to the outer air. A skylight in the roof, with an equal amount of glass area and provided with adequate ventilators, will be accepted in lieu of such window, but skylights are not desirable.

18. Windows—Minimum area to be measured between stop beads. Window head to be as near ceiling as practicable. Windows may be double-hung, pivoted, or casement. If double-hung, upper and lower sash to be the same size. In cities with soft coal smoke nuisance, minimum area to be increased.

Window frames to be designed to accommodate screens and outside shutters. In cold climates, weather strips are recommended.

II. Special Provisions for Houses of Types 1, 2, and 3.—In addition to complying with all general provisions, types 1, 2, and 3 are to comply with the following special provisions: Type 1, single-family house; type 2, two-family house ("two-flatter," one family upstairs, one down. For "double house," see single-family house, semi-detached.); type 3, single-family house with rooms for not more than three lodgers or boarders.

1. Arrangement—Types 1 and 3 not to be over $2\frac{1}{2}$ stories high. Type 2 not to be over 2 stories high.

When detached or semi-detached, types 1, 2, and 3 normally not to be over 3 rooms deep; when in rows or groups, not to be over 2 rooms deep except that the end house of row may be 3 rooms deep.

2. Cellar—To be well lighted, cross ventilated, dry and paved or cemented. Minimum clear height under joists, 6 feet 6 inches. When hot-air furnaces are used, minimum height 7 feet. Cellar not essential under whole house. Where climatic or soil conditions make cellar inadvisable it may be omitted, in which case adequate provision is to be made for storing fuel. Where cellar is omitted, house to be set up on masonry piers or walls 2 feet clear from ground; space to be drained, inclosed, and ventilated.

3. Grouping—Single-family houses of the more expensive type preferably to be detached houses, but may be semi-detached or even attached in rows or groups. In other cases where land values permit, detached or semi-detached are desirable; otherwise attached in rows or groups.

4. Heating—Provision to be made for heating houses. If not otherwise heated, bathroom to be heated from kitchen stove.

5. Materials of exterior—Brick, terra cotta, stone or concrete preferred; but wood frame clapboarded, shingled, or stuccoed permitted for detached or semi-detached houses not over $2\frac{1}{2}$ stories high. Party walls to be of brick, terra cotta, stone or concrete.

6. Plumbing—Bathtub (shower is not sufficient).

Lavatory, to be preferably in bathroom.

Sink to be in kitchen; rim 36 inches above floor.

Washtubs with covers, preferably two, rim 36 inches above floor, to be set in kitchen or in well-lighted, dry and ventilated cellar.

Water-closet to be inside the house in well-lighted and ventilated compartment, with window of 4½ square feet minimum area to outer air, and preferably with impervious floor not of concrete.

7. Rooms, Height of—Minimum, 8 feet.

Sloping ceilings and "knee walls" will be accepted only under the following conditions: Roof space above flat portion of ceiling to be of ample size and adequately ventilated; spaces between rafters of sloping portion to be adequately ventilated into roof space; bedroom to have greater window area and better cross-ventilation than the minimum permissible for a standard flat-ceiling room; bedrooms to have a minimum height of 8 feet over an area of at least 40 square feet with a minimum flat ceiling width of 3½ feet, and a clear height of not less than 6 feet over an area of at least 80 square feet with a minimum width of 7 feet.

8. Rooms in Attic—As a rule, in 2½-story houses, only one bedroom to be provided in the attic.

9. Rooms, Number and Use of—In types 1 and 2: For higher-paid workers, five-room type preferred, with parlor, large kitchen, 3 bedrooms and bathroom. Dining room and kitchenette may be provided in place of the large kitchen. Four-room type to be provided sparingly for higher-paid workers. Six-room type, with 4 bedrooms, or 3 bedrooms and parlor convertible into fourth bedroom, suited for abnormally large families only, and should be provided sparingly. Six-room type should normally have parlor, dining room, kitchen, 3 bedrooms, and bathroom.

For lower-paid workers, four-room type desirable, with parlor, kitchen, 2 bedrooms, and bathroom.

Any house having more than seven rooms to be treated as type 3.

In type 3, in addition to family quarters indicated above, single rooms for lodgers to be provided. In addition to the family water-closet accommodations, a water-closet compartment containing lavatory to be provided for the sole use of the lodgers. Lodgers to have access to their bedrooms and to their water-closet compartment without going through rooms designed for use of family.

10. Rooms, Size of—One large bedroom to be provided, size 10 by 12 to 12 by 14 feet.

Small bedrooms, minimum area, 80 square feet; minimum width, 7 feet.

Parlor, 10 by 12 to 12 by 14 feet.

Dining room, 9 by 12 to 12 by 14 feet.

Kitchen (where there is no separate dining room), 10 by 12 to 12 by 14 feet.

Kitchenette (only where there is a separate dining room), minimum width, 6 feet; minimum area, 70 square feet.

II. THE ONTARIO PROVINCIAL STANDARDS

The Ontario Housing Commission gives the following as essentials for a desirable house:

1. Sufficient land to give each family privacy and plenty of air.
2. Water-tight floors, walls and roof.
3. One, or more rooms for cooking, eating, and general day use.
4. Bedroom for parents' use.
5. Bedroom for male children.
6. Bedroom for female children.

7. Provision for toilet with sanitary water-closet and sewer connection.
8. Running water supply fit for drinking.
9. Kitchen sink with waste connection to sewer.
10. Uninterrupted daylight and ventilation through windows in every room.

Additional features which the Ontario Housing Commission deems so desirable as to be almost essential are:

1. Bath tub and lavatory, with hot and cold water supply.
2. Laundry tub with hot and cold water supply.
3. Direct sunlight in all principal rooms.
4. A second room, in addition to that used for cooking.
5. Clothes closets.
6. Porches and verandahs.

This Commission states that further additions of desirable features would include:

1. Electric light.
2. A separate dining room.
3. A cellar.
4. Furnace for heating.

The Ontario Commission has this to say of these standards, then makes the recommendations which follow:

These standards represent minimum requirements for safety, health, comfort, and convenience in industrial houses.

It should be possible to exceed in most cases the minimum stated both in the size of rooms and in the size of lots. It is suggested that in new developments Ontario may aim at least to equal the new English standard of not more than twelve houses to the gross acre in urban centres and eight houses to the gross acre in less populous districts.

Grouping.—It is recommended that a space of at least twelve feet be preserved between houses or groups of houses in all new developments; also in the case of houses with side windows, other than those from stairs, halls or pantries. However, where the size of lots is fixed or where existing buildings interfere, a narrower space may be unavoidable, but such passage should be at least four feet wide, without windows other than those from stairs, halls or pantries. Houses of frame construction, in whole or in part, should have a space of at least fifteen feet between them.

Duplex houses or cottage flats are recommended only as a substitute for tenements. They should not be more than two stories in height, and not more than three rooms in depth, except the end house of a duplex group, which may be four rooms in depth.

Open Spaces.—The rear of the house should be at least fifty feet from the rear of the lot. In new developments the front wall of the house, projecting steps or verandah should not be nearer than twenty feet to the street pavement or roadway.

Space for gardens is desirable, also play space for children. Local conditions will determine whether there should be individual or community allotments and play-grounds. Access to the rear should be provided; in the case of group houses service lanes are desirable. These should be paved, drained, lighted, and not less than twelve feet in width. Four-foot passage-ways between buildings should be paved.

Outbuildings are not desirable.

Fences.—Open fences or hedges are recommended. Close board fences are not acceptable.

Size of House.—Minimum number of rooms, four, exclusive of bathroom and kitchenette.

Arrangement of Rooms.—No house should be more than two rooms deep unless it has at least twelve feet of clear space between it and the next building, in which case detached, semi-detached and group houses may be three rooms deep, and duplex houses may have a depth of four rooms.

Type of Houses.—Four-room type: Living room, kitchen, two bedrooms and bathroom, or living room, dining room-kitchenette, two bedrooms and bathroom.

Five-room type: Living room, dining room-kitchenette, or kitchen, and three bedrooms and bathroom.

Six-room type: Living room, dining room, kitchen, three bedrooms and bathroom.

Minimum Size of Rooms:

Living room....	144 sq. ft.,	narrowest dimension	11 ft.
Dining room ...	120 " "	" "	10 "
Kitchen	80 " "	" "	8 "
Kitchenette	50 " "	" "	6 "
Bedroom No. 1.	120 " "	" "	9 "
Bedroom No. 2.	100 " "	" "	8 "
Bedroom No. 3.	75 " "	" "	7 "
Bathroom	35 " "	" "	5 "

Where the kitchenette opens from the dining room with a doorway of six feet, the minimum combined width of dining room and kitchenette, including the intervening partition, may be fifteen feet.

Clothes Closets.—Clothes closets to be provided for every bedroom, in addition to the areas specified, the closet to be not less than 22 inches deep, to be fitted with rod for coat hangers, and to have a door at least 2 feet in width.

Ceilings.—Minimum height of ceilings, 8 feet.

Sloping ceiling will be acceptable only under the following conditions: Roof space above that portion of ceiling to be of ample size, preferably, ventilated; space between rafters of sloping portion to be adequately ventilated into roof space, bedroom to have greater window area and better ventilation than the minimum permissible for a standard flat-ceiling room; bedrooms to have a minimum height of eight feet over an area of at least forty square feet, with a minimum flat ceiling width of 3½ feet, and a clear height of not less than 6 feet over an area of at least 75 square feet, with a minimum of 7 feet.

Furniture Space.—Beds to be indicated to scale on plans (double beds 5 feet by 6 feet 6 inches; single beds, 3 feet by 6 feet 6 inches). Location of beds not to interfere with windows or doors. It is recommended that beds be free-standing and not located in a corner or with the side against a wall. Space to be provided for two pieces of furniture in addition to bed. To allow moving of furniture, doors to be not less than 2 feet 6 inches in width.

Stairs.—Risers to be not more than 8 inches high, and treads to be not less than 9 inches wide. Winding stairs to be accepted. Treads to measure at least 9 inches wide, 18 inches from rail. Two winders, and not more than two, are required in a right-angle turn.

To allow for moving of furniture, stairs shall be not less than 2 feet 9 inches in clear width.

Cellars.—No living quarters to be in basement or cellar except where the land has a decided slope.

Cellar to be lighted by at least one window opening directly to the outer air and to be provided with another opening located so as to provide cross-ventilation.

Cellars or basement to have a clear height of 6 feet 6 inches.

The walls and floors to be damp-proofed or water-proofed, as conditions may require. Where conditions require water-proofing, weeping tiles to be placed around the footings and graded to follow the natural flow of the ground water.

Floors to be of concrete, with cement finish, graded to drain to be connected with the sewer.

Where the cellar is omitted, foundations may consist of either continuous masonry wall, or masonry piers 2 feet from finished grade to first floor. The space under the house to be drained, enclosed and ventilated.

Light and Ventilation.—Windows may be double-hung, pivoted or casement. If double-hung, upper and lower sash to be the same size, and both to be movable.

Every room to have at least one window opening directly to the outer air. One window is sufficient in small bedrooms, but more than one is desirable in other rooms. Each room to have a window area of not less than 12 square feet. Minimum window area to be measured between stop beads. Window head to be as near ceiling as practicable.

Cross-ventilation, as direct as possible, to be provided for all rooms through windows, transoms, or doors.

Every bathroom to have a window of not less than 6 square feet in an area opening directly to the outer air.

Every water-closet compartment to have a window of not less than 4½ square feet in area opening directly to the outer air. A skylight in the roof with an equal amount of glass area and provided with adequate ventilation will be accepted in lieu of such window, but skylights are not desirable.

Plumbing.—Bath-tub to be a one-piece fixture; shower not sufficient.

Sink to be in one piece, preferably of enamelled iron with integral back; rim to be 36 inches above the floor.

Wash tubs to be in kitchen or cellar. When placed in kitchen, an enamelled iron one-piece combination sink and tub is recommended. When placed in cellar, two tubs are recommended, to be of enamelled iron, preferably, or of cement. Rim to be 36 inches above the floor.

Water-closet to be inside the house in bathroom or in well-lighted and ventilated compartment (not in cellar) opening upon hall or passageway. Fixture to be of porcelain, of the siphon, or siphon-jet type, to have a large water-way, and to be provided with an individual flush tank.

House drain to run from bottom of soil stack to a point 3 feet outside the wall of the building, to be medium weight cast iron pipe, of a minimum size of 4 inches. Soil pipe to be of cast iron, standard weight, minimum size of 4 inches, and to be extended through the roof for a distance of at least 3 feet.

Hot and cold water to be provided to sinks, laundry tubs, baths, and lavatories.

All fixtures to be provided with proper drains.

All fixtures to be separately trapped, except in batteries of laundry tubs and combined sink and laundry tub, where one trap is sufficient.

Ventings of traps to conform to approved practice, except that the back venting of the top or only fixture on a line is not required. Sink and lavatory traps to be connected direct to the vertical wastes, and not to floor branches. Exposed pipes preferred; where possible, lines to be concentrated, and kept from outside walls.

Heating.—Where furnaces are not provided, rooms to be arranged and chimneys located so that stoves may be conveniently placed. The bathroom to be adequately heated. The kitchen flue to be of sufficient size to permit the use of a coal range for cooking, and to be lined with tile flue lining, or parged.

Lighting.—Electric light is preferable.

Materials.—Brick, hollow tile, stone or concrete preferable.

Wooden frame with exterior walls of stucco, shingles, or clapboard acceptable for detached or semi-detached houses.

Wooden frame with exterior wall of stucco acceptable for group houses.

Outer walls to be insulated against dampness and condensation. Rat nogging to be provided.

Division walls to be of brick, hollow tile or concrete.

III. UNWIN'S ENGLISH STANDARDS

In *The Nation's New Houses*, Raymond Unwin, of England, gives the following rules for planning the house and its surroundings:

Frontage.—Give the house a wide frontage.

Aspect.—Consider this carefully before building the house, because—

(1) The living room must be sunny.

(2) The larder must be cool.

Living Room (Kitchen).—This room will be the centre of the home life. See that it is comfortable.

Don't let it be turned into a passage by badly placed doors.

Don't let the fireside be spoiled by draughts.

Don't have cupboards that are in constant use on both sides of the fireplace.

Don't let the front door open directly into the living room.

See that the cooking arrangements, whether here or in the scullery, save unnecessary walking about.

Scullery.—Don't let the scullery be draughty.

Don't place steps between the scullery and the living room.

Don't let the back door open directly into the scullery.

Don't set the sink too low. Put it in a good light, and make it deep, with the taps sufficiently high to allow pails to be easily filled. There must be hot- and cold-water taps. A cold-water tap, waste outlet, and proper steam vent should also be provided to the copper.

Larder.—This should be of ample size, not merely a food cupboard.

It should face north or east.

It should be ventilated by a window direct into the open air, and an airbrick, both protected from flies with wire gauze.

It should have a cold slab of either slate, stone or concrete, and plenty of shelves.

Economy of Labor.—All the arrangements with regard to the preparation of food, and the relative positions of sink, range, scullery, larder and living room should be so planned as to save labor.

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[1] Quoted from *Housing Betterment.*

Parlour.—Don't let this room take precedence over the living room either as regards size or aspect, but it should have some sun—a western aspect is best—and should be comfortably arranged.

Coal Store.—It should be of good size. It should be reached under cover. If it opens off the scullery a coal chute should be provided for filling from outside.

Water-closet.—It should be under cover if downstairs, opening off a well-ventilated lobby, or landing if upstairs.

Bath.—If downstairs, this should be in a separate room, and not in the scullery unscreened. It should have a hot- and cold-water supply and waste outlet.

Entrance, Passages and Stairs.—These should be well lighted and ventilated.

Avoid long passages.

Avoid steps in passages.

Avoid narrow, steep or winding stairs and provide a handrail.

Bedrooms.—These should be well lighted and ventilated.

There should be a place for the bed out of the draught, and good dressing space.

Fixtures and Mouldings.—Aim at simplicity. Think of the dust.

Have plenty of cupboards.

Windows.—See that your windows can be opened in all weathers, can be easily cleaned, and are big enough to see out of when sitting in the rooms.

Out-houses.—Avoid back additions. They spoil the outlook and keep the air and sunshine from the windows. A place for tools and vegetables should, however, be provided without shutting out light and air.

Garden.—No garden, no home.

The Surroundings of the Home.—Do not plan your town, suburb or village piecemeal. Think of the whole.

Do not build more than 12 houses to the acre in towns, or 8 to the acre in the country.

Do not neglect natural beauties in your scheme.

Do not cut down trees and uproot hedges.

Do not build in continuous rows of more than four or six.

Economize in road construction by having narrow carriage-ways where there is little traffic, and have grass margins.

Vary the building line by: Grouping houses round quadrangles and squares, and setting back some houses behind the main building line.

Avoid back roads (alleys), which are unsightly and expensive. Substitute passage-ways between the houses for the supply of coal and removal of refuse.

Remember the children. Give them a playground not too far from home. Let it be a real playing ground, not a flagged yard.

CHAPTER XX

REDUCING THE COST OF SHELTER

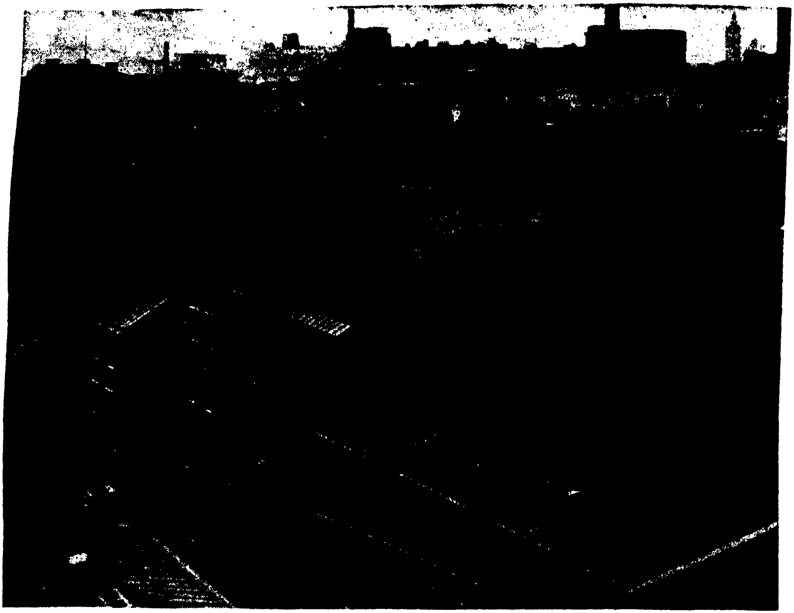
It is the consensus of opinion that the best dwelling-place for the typical family is the detached house with modern conveniences and with more or less garden space around it. Some maintain even that such a dwelling is essential to normal living. While we may expect to have always with us subnormal individuals who cannot unaided attain the normal standard of living, it is agreed that the average family should be financially able to live according to desirable standards, yet under present economic conditions the type of house which we consider should be the standard is too costly for the majority of families either to own, or to rent. The cost of shelter is first the sum of the cost of land, materials, labor and capital, plus a second cost, that of upkeep. Students of the housing problem have sought for remedies for the high cost of shelter and suggest certain measures for relief, to wit: (1) Reduction of the cost of shelter by cheaper production; (2) reduction of the cost of shelter by eliminating or greatly reducing the difference between actual cost of production and the price paid for purchase or for rent by the ultimate consumer; (3) reduction of the cost of upkeep for the standard low-cost house by sound construction and by changes in the tax system; (4) reduction of the original cost of land and improvements and of the cost of upkeep by town planning. The first three suggested remedies are discussed in this chapter; town planning, which besides being part of any constructive housing program has other elements of interest for us, is discussed in a separate chapter.

Land Value.—The price of a building site depends upon its inherent value for the purpose, upon the cost of improvements charged to it and upon the intensity of the use of the surrounding land, in other words, upon the demand, existent, and future and speculative.

Intrinsic Value.—In the outlying districts of a city the value of a site is affected by its drainage, outlook, eminence, its trees and shrubbery, and by its adaptability to house construction. The site may be so difficult to build upon that it is suitable only for an expensive home. Care should be taken to reserve as sites for cheap dwellings, such lots as can be improved and built upon at the lowest possible cost.

Improvements as a Factor in Land Value.—The cost of improvements accounts for considerable variations in prices of lots in different localities of similar character. In some places where necessary improvements such as sewers and streets have been well built of good material and without graft, and where desirable improvements, such as boulevards and parks, have been carefully studied and placed, and the cost equitably apportioned, prices are reasonable. In other places where improvements have been made in excess of the actual and potential needs, and illegitimate profits taken by the use of inferior material or by exorbitant charges, the cost of lots is excessive. The way to avoid such excessive cost is obvious. As the density of population increases, the cost of improvements increases, water mains and sewers must be larger, streets must have heavier paving, fire protection must be increased and there should be more parks to secure proper ventilation. So the cost of improvements depends in part upon the third factor in the cost of the site, that is, the intensity of use of the surrounding land.

Value Given to Land by Use, and Methods of Control.—As remedies for the high cost of land due to demand, the following policies have been suggested, the single tax, municipal ownership, and limitations upon the use of land. The single tax upon land alone, it is claimed, would encourage building and would make it impossible to hold vacant, land in the city very long, and therefore would prevent speculation which piles profit upon profit to be finally paid for by the householder (Fig. 178). This would insure cheap building sites, besides confiscating for the use of all, the value given to land by the concentration of population in cities. The possibility has been pointed out that such a tax, unless accompanied by restrictions, as to the use of the land, might not work out as outlined, that it might lead to the erection of extremely high buildings, or land-sweating. It is also thought possible that while bringing into use land within the city, outlying land might still be dealt in by speculators, and that since only capitalists could afford to pay the high taxes on land available for building, there would be many forced sales to them as agricultural land on the outskirts came to be needed for city growth. It would certainly be a difficult matter to adjust taxes fairly, to draw the line between agricultural land and city land, it would seem as if confiscation of land would be simpler and the logical result of any continued and consistent attempt to carry out the idea of the single tax.



Courtesy of Cincinnati Better Housing League

Fig. 178.—The land in this residence district has a high value because of the congestion.

Municipal ownership is a method for the control of land values which has been tried and proved to be satisfactory. Certain German cities have pursued this policy for some time, the city of Ulm owning over eighty per cent. of the land upon which it is built. In this way the municipality prevents a promoter reaping the profit which he would otherwise extort from those who occupy the houses built upon the land which he bought cheaply. Cheap land on the outskirts helps to keep down the price of land nearer the centre of the city. It is not necessary for the city to own all the available surrounding land, municipal ownership of the greater part of it keeps down the price of all. In this country this method has not been tried except that in making improvements a city has sometimes condemned land in excess of the actual needs and after the improvements were made, has sold this excess at prices which if the improvements had enhanced its value helped to pay for them. If the improvements injured any property, its condemnation and purchase by the city obviated the necessity for making adjustments with the owner. High land prices are due largely to speculation and monopoly and combines among real estate dealers. Municipal ownership prevents this, but why could it not be prevented by legislation? If we can legislate against speculation in eggs, why not against speculation in land? Some one has suggested that if all vacant lots over three or four owned by any one person for two years had to be put up at auction, this would prevent speculation and make more for home building.

We have already in many places restrictions upon the use of land, objectionable trades may not be carried on in some sections of cities, buildings must be partly or wholly fire-proof within certain districts, and the height of buildings is limited. Greater restrictions are advocated, especially as to the height of buildings used for apartment and tenement dwellings, and the proportionate part of the lot that may be covered by the building. Increase in the height of such buildings is accompanied, it is claimed, by decrease in the size of the rooms, increased rent, and increased land value, due to the greater intensity of the land use. Restrictions as to the number of dwellings to the acre is another means of preventing intensive use of land and of keeping land values low. Districting regulations or zoning which will prevent business creeping into residence districts and apartments coming into detached residence districts and upsetting land values, are recommended.

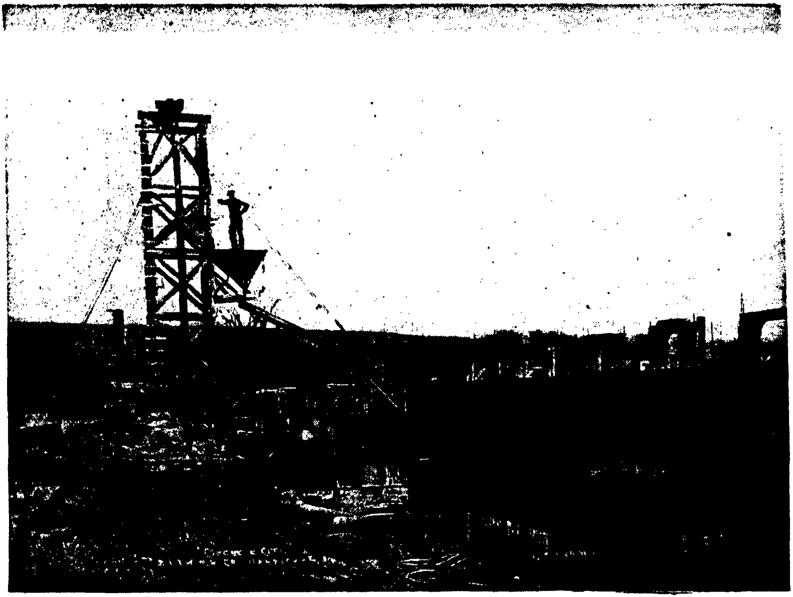
Materials as a Factor in Cost of Shelter.—The cost of the materials which enter into building may be lowered in three ways. A downward revision of the tariff on lumber would cut the cost of the frame house and perhaps the cost of houses of other materials which compete to a certain extent with frame ones, for keeping up the price of lumber tends to keep up the price of other materials which may be used in its stead. Preferential freight rates for building materials have been suggested as a means of reducing their cost, but this would be manifestly unfair unless such rates would be made to cover all the necessities of life, with a higher rate on the luxuries including building material for luxurious houses, and such a differentiation could probably, if desirable, be better secured by taxation. We may learn to use materials less expensive than those we are accustomed to. In this connection, of course, the cost of labor must be counted, for some materials require either more labor or a greater amount of skilled labor than do others. Aside from glass and structural iron and steel, our chief building materials have been in use for thousands of years, but some are not as extensively used as sometime they may be when we become more familiar with them. Some of the synthetic building materials now on the market or in process of development may prove cheaper than those now in use.

Labor as a Factor in Cost of Shelter.—That part of the cost of the house which represents labor also might be lowered in three ways, namely, by a lower rate of pay, by less labor, and by greater efficiency. The first way is not desirable, except as the price of all commodities drops, the other two are well worth consideration. Greater use of machinery, standardization of building units as discussed in Chapter V, and material requiring less labor are all measures which meet with universal approval. Assembling houses from standardized factory and machine made units such as wall, floor, and roof panels obviates the cutting and fitting now done by hand in ordinary building operations. With suitable insulation, ground floor heating systems, and materials unaffected by lack of ventilation, basements and high foundations are eliminated.

Economy of plan is a most important factor in keeping down the cost of both materials and labor. Many plans are poor in that they waste space and therefore material and labor. The architect's technical knowledge is valuable, yet too many people do not realize this and do without an architect because of the expense. A good architect can save his client both material and labor.

In several of our cities there is what is called "The Architect's Small House Service Bureau," an organization of architects which supplies very good plans for houses at a reasonable cost. This is possible because of coöperation in making the plans, and because the same plans are used in different places, so cutting the cost of the architect's labor.

The Cost of Capital.—The cost of capital invested in a house varies. If a man has the necessary money to put into a house it will cost him to do this the interest his money is bringing him, the inevitable depreciation in value of the house, and, under present conditions, supposing the money to be absolutely safely invested, for instance, in government bonds, a degree of safety of the investment which is possibly offset by the chance for gain. Stabilizing of real estate value will increase the safety of the investment, and depreciation of the building, while inevitable, may be minimized by sound construction.



Courtesy of *Low Cost Cottage Construction in America*, Harvard University.

FIG. 179.—The use of machinery saves labor in building. This machinery and the metal forms are practical only for large scale building operations.

Cost of Borrowed Money.—If the money for the house must be borrowed, it may cost as much as ten to fifteen per cent. a year. In France it can be had for two to three per cent. a year. When money is borrowed giving a mortgage on real estate as security the owner of the property pays a double tax, one on his house and lot and another on the mortgage. If the mortgage on low-cost dwellings might be tax-free, this would reduce the cost of capital because while the person who holds the mortgage pays the tax on it, this is passed on to the borrower in the form of the rate of interest he pays. Money might be lent on a tax-free mortgage at a lower rate of interest than that now customarily charged. Most straight mortgages (i.e., those not amortized) are commonly made for a period of three years. If a mortgage is not paid in full when it is due it must be renewed. A charge is almost invariably made for renewal and this item must be included in the cost of borrowed money.

The Building and Loan Associations of America have done a great deal for home building, but the usual rate of interest charged is six or eight per cent. and to this must be added the premium paid at the time of borrowing, which in some places must be at least fifteen per cent. and often, when the demand for money is great, runs up to double this rate. However, in the Building and Loan Associations in which the borrowers are stockholders, the borrower benefits by the high rate of interest, because as rapidly as he pays the instalments on his loan the money is lent out again at interest and for a premium which accrues to his benefit. Considering the amount of money a man borrows and pays in to cancel the debt, it is found that the excess of the latter over the former divided by the number of years through which payments are made gives a sum which is only four or five per cent. of the sum borrowed. So, while the rate of interest charged may be high, yet due to the rapid amortization of the loan, the interest actually paid on the sum borrowed is low, when figured as indicated.

Ways of Reducing Cost of Borrowed Money.—If the cost of borrowing money for building were reduced, doubtless there would be more home building. Banking institutions as a rule invest their funds wherever they can get the highest rate of interest consistent with safety and they are limited as to the proportion of their funds which may be lent on mortgages.

Philanthropic and limited dividend companies have provided funds for occasional housing developments. The Metropolitan Life Insurance Company, which formerly preferred loans in large amounts and in the business sections of large cities, has for some time past made loans on small dwellings and apartment houses in all parts of the country with the avowed intention of relieving the shortage of houses of moderate cost, which, it states, should be relieved by institutions which handle the savings of the people, particularly life insurance companies and savings banks. This company also has a very large housing development of fifty or more apartment buildings, housing thousands of families (Figs. 171 and 182).

It is considered impossible to demand that capital for home building be lent at a lower rate of interest than can be obtained with the same degree of security when it is lent for other purposes unless the money is in a sense public capital. Some European countries, however, even before the World War required of banking companies that a certain proportion of their funds be used at home to finance the building of certain types of homes, the money to be lent at a low rate of interest. For many years it has been possible in certain foreign countries for individuals and for limited dividend housing companies to borrow money for low cost dwellings at as low a rate of interest as two per cent. for the least expensive homes, from savings banks and in some instances from the government through the post office.

The Canadian Federal Government in 1918 appropriated twenty-five million dollars to be loaned to the Provinces and by them to the municipalities for the provision of houses for a crowded population. A loan may be made to build a single house, but the act encourages large developments, and sale to the individuals on the monthly payment plan. The province of Ontario, by the Dwelling Act of 1919, attempts to improve the character of small houses by stipulation as to the plotting of the land, the plans of the houses, the size of the rooms, the sanitary conveniences, light, ventilation, and materials used in construction. The standards set are far beyond those of most cities in the United States in pre-War time (page 288).

For years the question of government aid for home-building has been discussed in this country. During the World War the Federal government lent money to large corporations for financing housing developments for their employees. The houses which were built from these funds had to meet certain standards (page 285). The State of California has lent money to veterans for home building at lower rates of interest than the prevailing ones. These loans were financed by State bond issues.

United States Federal Housing Act of 1934.—The Federal government is seeking to stimulate home building, modernizing, remodelling, and repairing homes through a reduction in the cost of money by means of long term financing at a rate of interest below that usually charged. The plan is to provide capital through the sale of government bonds which will be lent through private institutions already existing or to be formed, to home builders and owners. This plan was authorized by one of the last acts passed by the Seventy-third Congress, called the Housing Act of 1934. Anyone who wishes to build a new farm or city home for himself may borrow up to eighty per cent. of the appraised value of the project. Those who wish to build as an investment, a small single house or a two to four family house for rental to wage earners may borrow up to sixteen thousand dollars according to the terms of this act. Sums up to two thousand dollars may be borrowed for modernizing and repairing. These loans are all to be amortized over a period of years and the interest charged is comparatively low.

The institutions through which such loans are to be made will be insured against possibility of excessive loss through a form of mutual insurance to be paid for out of the interest charged the borrowers and by the government's guarantee against loss up to twenty per cent. of the total amount of loans made for repairs.

In any new building under this act the standards to be observed are those of the local community.

Insurance to Protect Equity.—Whenever, and however, money is borrowed for paying for a home, the family should be protected against loss of their equity in it, through the death or incapacitation of the wage-earner. This may be done by the individual by taking out insurance to the amount of the mortgage, but it is a matter often neglected. This might be made compulsory for any borrower of funds over which the government has control and should be adopted by the Building and Loan Associations.

Reducing Building Cost by Wholesale Production.—Building operations conducted on a large scale are always more economical than small operations, raw land may be purchased and developed to suit the requirements of the buildings contemplated, at a less cost than improved lots which must pay a profit to the promoter, and which have not been laid out with special consideration for the houses to be built upon them (Fig. 180). For a large undertaking of fifty or more houses a well-trained architect may be employed, for he can undertake such a proposition at a lower rate than he can undertake the planning and supervision of one house. Materials bought in car load lots are cheaper than when purchased in small quantities and labor may be more economically employed on a number of houses put up at one time and by the same person than on many small jobs. Even the financing of a large undertaking costs less in proportion than the financing of a small one. There are other advantages in the large housing development, it makes it possible to have a more harmonious *ensemble* than when there is no general scheme, for the houses may be so designed that there will not be such discordant effects as we sometimes see when each man builds his house without considering the dwellings of his neighbors. Building on a large scale to reduce the cost of shelter may be undertaken by commercial housing companies, which of course must find a profit, by coöperative societies, by employers for the benefit of their employees, or by the state or municipality. The first two methods of handling the housing problem cannot be objected to, the third has disadvantages, giving the employer too much control over his workmen except when the employer turns this matter over to a separate company, perhaps a community one, and the fourth is unobjectionable if the housing

FIG. 180.—The Lehigh Coal & Navigation Company built wholesale these houses for its employees.

developments undertaken are self-supporting, paying a reasonable return on the money invested in them (Fig. 181).

Coöperative Societies.—Coöperative societies for purchasing household supplies have flourished in Europe for a good many years and co-partnership tenant societies have developed along similar lines. In this country, we are not very familiar with coöperative societies, but there are a few, and in Milwaukee the Garden Homes Company was incorporated for the purpose of securing funds by the sale of preferred stock paying five per cent., for the building of homes to be rented to members who must subscribe for common stock. If ever it becomes necessary for the tenant stockholder to give up his home, the company must purchase his common stock at its par value less any damage the house may have suffered during his occupancy. The ownership of stock in the company does not hamper the tenant in case business calls him away from the locality as would owning an individual house, yet by this coöperative scheme each tenant stockholder enjoys the benefits of house ownership. So important was this enterprise considered that both the City of Milwaukee and the County of Milwaukee subscribed to the preferred stock of the Garden

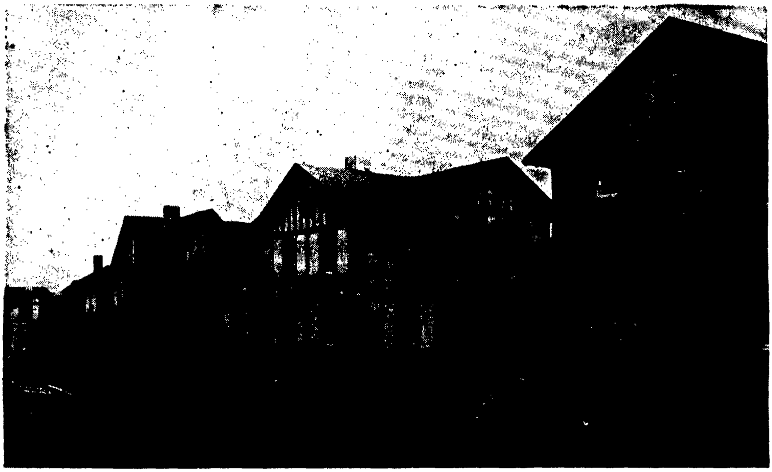
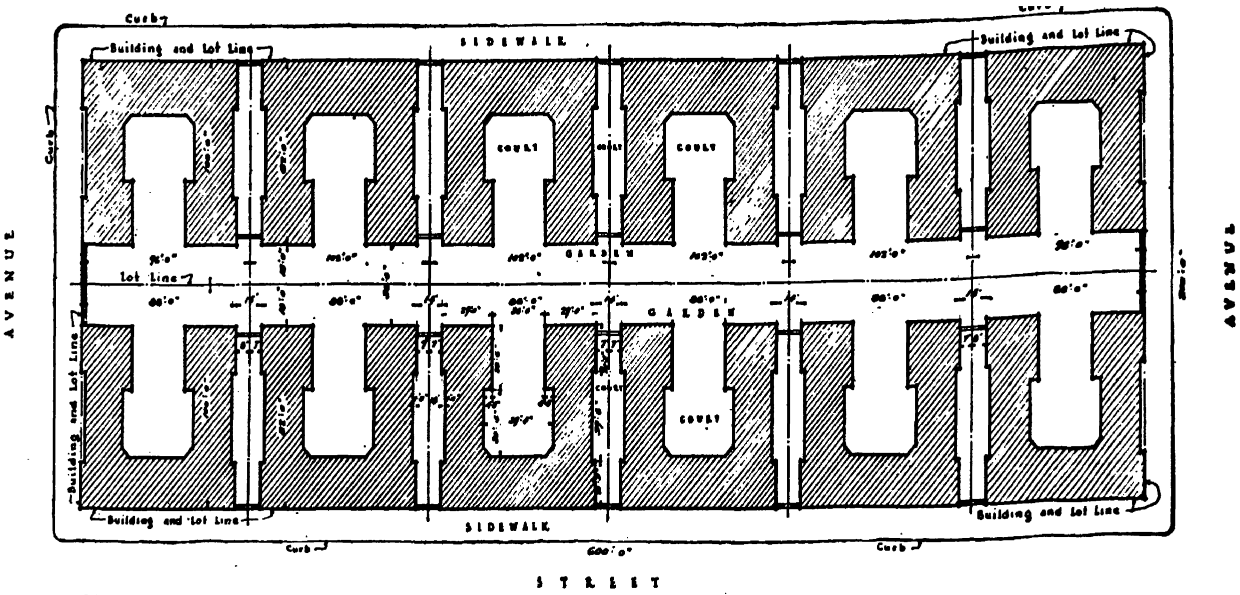


Fig. 181.—These houses at Morgan Park, Minn., the result of large scale production, have individuality, yet will make up an harmonious residence section.



Courtesy of A. J. Thomas and D. E. Ward.

Fig. 182.—Plan of one block of the Metropolitan Life Insurance Company's development to house, in fifty buildings, nineteen hundred and fifty families, to cover four blocks in Long Island City. Planning the block as a whole makes it possible to concentrate the areas which would otherwise be light courts into one large continuous area extending from street to street on all sides and so to provide each room with good light and ventilation. Planning in this large way also makes it possible to eliminate the halls usually found in tenement buildings which are not only waste space but add to the cost of building and upkeep. See typical floor plan, page 273.

Homes Company, in order to help supply the initial capital required. This is one of the most important housing projects in the United States at present.

Cost of Upkeep.—Besides the cost of land, materials, labor and capital, there is the second cost of shelter, that of maintenance, repairs, insurance and taxes. The well-built house costs less to keep in repair than the house built cheaply and meanly and the cost of repairs must be considered in connection with the first cost. In connection with repairs the old adage, "A stitch in time saves nine," should be remembered. Fire danger is less when the number of houses to the acre is small, and when houses are built in whole or in part of fire-proof materials, so this last must also be considered with the cost of materials. The tax rate of different cities varies and is determined largely by honesty and efficiency in government and management. Much of our tax money goes to remedy evils resulting from lack of city planning and from poor housing. Taxes might be reduced by efficient administration, town planning to secure adequate but not excessive improvements, and the promotion of proper housing accommodations for the poorer part of the population. In order to help to make the single house cheap enough for those families which can pay only a small rent, it has been suggested that houses costing under a certain sum and coming up to certain standards of sanitation, comfort and repair, and, when not occupied by the owner, rented at an approval rental, be exempted from taxation. Cities frequently offer tax exemption to induce factories to locate within their confines or to promote the building of business blocks, and since we are familiar with the graded income tax the idea of a graded house tax exempting from taxation some dwellings and putting the greater tax on the luxurious house, is not as radical as it may seem at first thought. The New York law which exempted from taxation for ten years houses built in the years 1921-23 was intended to encourage building. Unfortunately specifications as to the type of building were not adequate to promote the best developments and the speculative builder in many cases did his worst.

Rent Profiteering.—There is another factor in the excessive cost of shelter for the renter in what we are accustomed to call rent profiteering, that is, the landlord responding to an increased demand for houses by raising the rent. However since he suffers loss in times of depression, it is only just to allow him profit enough in good times to recoup his losses. In some places, it is possible for persons who feel that their rent is exorbitant to appeal to some authority for relief, and require the landlord to justify in court his higher rentals. We might everywhere control this matter by law.

State or Municipal Housing.—It has been suggested that the city or state should build houses and rent them at cost or less than cost to unskilled laborers. This means subsidizing with public moneys those industries which employ unskilled labor, and this is inadvisable. The suggestion that the city or state should provide houses for those unfortunate families that because of physical or mental deficiencies or because of the death or illness of the wage-earner, are so poor they cannot afford to pay the rent necessary to secure adequate shelter, is another matter. The state as well as philanthropy gives aid in many forms to indigent families and individuals. Probably shelter could be better supplied them by paying their rent than by the state building dwellings for them. Philanthropy, besides dispensing charity, has other functions, and one is to lead the way to social betterment and to set standards. Most of the pioneer work in housing reform was done by charitable organizations which put up what were at the time considered model tenements, and which were rented to return less on the investments than was usually demanded or to bring in no revenue or even to sustain loss. Doubtless for many years to come philanthropic housing projects will continue to play their part, but state or municipal housing schemes should not be undertaken unless it is necessary to do so to provide proper dwellings for certain classes of citizens, and unless these dwellings are sold at a small profit, or are rented at a price to return some interest and to pay for themselves within their lifetime.

PROBLEMS

1. Do laborers in your community live in houses which come up to the standards you advocate?
2. What is the cost of the typical house of a laboring man in your community? Is this excessive? If so, what factors make it so? What would the standard house for a laboring man cost?

3. What schemes for reducing the cost of shelter seem practical in your locality?
4. Have the improvements in your town been carefully planned and made at a reasonable cost? If not, why? What could be done to remedy matters?
5. Compare prices of lots on "Main" Street, "Railroad" Avenue, in the best residence district, in the poorest residence district and half a mile from the edge of town. What are the reasons for the differences?
6. What restrictions as to the use of land do you have in your community?
7. Compare the tax rate of your town with that of others near by. Explain the differences.
8. Does your town own any real estate? What is it? Is the cost of upkeep reasonable? Were the buildings, if any, put up economically?
9. If a graded house tax were to be established dependent upon certain features (once upon a time there was a tax on windows), which of these would you consider should be tax-free? Upon which would you put a supertax?
10. If there is a Building and Loan Association in your town, find out the rate of interest charged on borrowed money figured as indicated in the text. What would be the cost of money obtained from other sources?

CHAPTER XXI

TOWN PLANNING

Any analysis of present-day living reveals our growing dependence upon agencies outside the home. Even farm families are becoming less self-sufficing and to realize the necessary money income must keep in close touch with markets. Farm and city homes are knit together by telephone, telegraph, radio, the means of rapid transportation, and the lines carrying power and light. City homes have still other connections, in the pipes for gas and water supply and sewage removal. Children are trained and educated by the public school. They and their elders enjoy public libraries, museums, parks, concerts, and sports. They are served by commercial laundries, bakeries, and other industries, and share commercial entertainments. This socialization of utilities and educational and recreational facilities, and the sharing of services impose conditions on living together in groups which can be met with the least cost in money and without sacrifice of health, physical comfort, privacy, or beauty only by community planning.

The owning of real estate has been, and is, a speculation; one cannot tell whether a purchase is to increase in value, be stable, or decrease, and this leads to gambling in real estate, to manipulation of the market, to high rents, and to fewer houses owned by the occupants. If the owning of real estate were more often an investment instead of a hazardous venture, people would have better houses and homes. One of the chief reasons for the fluctuations in value of real estate is the random and fortuitous way in which most towns grow and the consequent changes in the character of neighborhoods. Much may be done to stabilize values by following a plan which confines factories and plants to a suitable section, furnishes dwelling sites convenient for their operatives, and affords a location for business interests which may be extended without encroaching upon a residence district.

Town planning promotes economy by fostering rational improvements: land for parks and boulevards is taken while it is comparatively cheap; by arrangements for quick, safe transit from

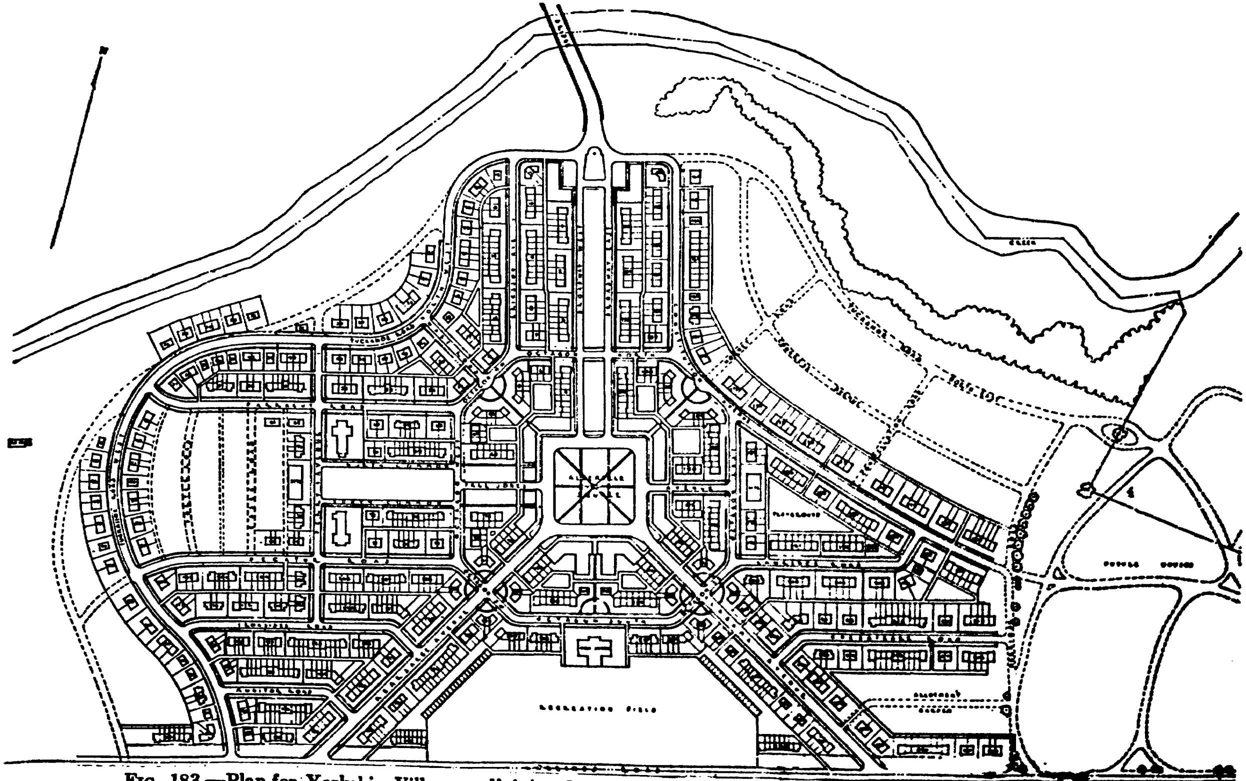


FIG. 183.—Plan for Yorkship Village—adjoining Camden, N. J., built by the Emergency Fleet Corporation.

one section to another, time as well as money will be saved; a district which is to be, for many years at least, a residence section will not be burdened with the cost of expensive street paving; and the manufacturing districts will be located on level ground requiring little grading to accommodate the busy traffic, and with the needed railroad accommodations at hand or easily obtainable.

Even in a town which in response to the demand of circumstances springs up in a spot with few natural advantages, town-planning might do much to minimize the deficiencies, whether these pertain to water supply, drainage, climatic conditions or outlook.

The matter of the ventilation of the city is important. In cities in which this has not been considered there are sections in which there is stagnant air which might be freshened by the opening of broad streets in the direction of the prevailing winds. Other places are cold and windy due to cross currents which form disagreeable eddies. The healthfulness of most of our cities might be greater if they had wide streets where high buildings rise, and streets running in other directions than duly by the needle of the compass, so getting more sunlight into the buildings which line them. Good town planning enables the citizens to have the benefits of the natural beauties of the place when parks and streets are laid out, but if parks are not planned for before buildings have sprung up over the area they cannot be made later without great expense.

The Town-planners' Problems.—There are certain general principles which apply to all town planning, although each city has its own specific problems to deal with. The industrial life of the city imposes conditions which vary in different places. A fishing village, a mill town, a tourist city, require different arrangements. The matter of securing sanitary conditions is a special problem for each city, depending upon the latitude, the water supply, the drainage and the air currents of the site upon which it is built, the climate, and the nature of the chief industries. Modern social life could not be carried on in a mediæval city and is hampered in many modern cities by cramped streets, lack of open spaces, poor transportation and poor lighting. An industrial town or section of a city with a large foreign population in need of Americanization should be provided for differently as to facilities for fellowship from a town or section with a wealthy migratory native population. Every place should have as much of beauty as it is possible to give it, but the natural beauty that is to be brought out and emphasized, is an individual matter for each city.

The problems which the town planner must meet are the following: There must be accommodations for the business of the city, this may be merely exchange, buying and selling, but in most places there is a certain amount of production as well, then there must be residence sections for the workers and their families, and places of recreation and amusement. These districts must be laid out, each in the best location for it, and with the best means of communication between them. So the town planners' problems are those of districting and street planning, with the aims of city planning kept constantly in mind. Districting is the easiest of these problems.

The Business District.—The business part of town must have, first of all, means of transportation into and out of the city, railroads and waterways, if these are accessible; second, it should be on level ground to keep down the cost of transportation within the district and to avoid making expensive cuts and fills where streets are built. The manufacturing and the wholesale districts require these means of transportation more than does the retail district. Dangerous or offensive occupations should be segregated and located where they will be least objectionable.

In a large city small business centres which usually include a picture show and a garage spring up in the outlying districts. These serve the neighborhoods they are in. Often, however, they are a detriment to the immediate surroundings. Apartment houses also are not considered desirable in a section of one-family houses. Some city additions which have been planned in advance have a block designed for stores and apartments. Sometimes there is a small park in the centre, sometimes the store fronts are behind arcades which mask them to some extent, but a block frankly devoted to business need not be an eyesore as many attractive shops and store windows testify (Fig. 184).

The Residence District.—Residence sections are next to be considered. There must be low-cost districts for the unskilled and the semi-skilled workmen, and better neighborhoods for those with greater incomes. In most of our cities it is a fact that the richer people live on the cheaper land, they get out into the suburbs, while the poor live in tenements where the ground cost is high.

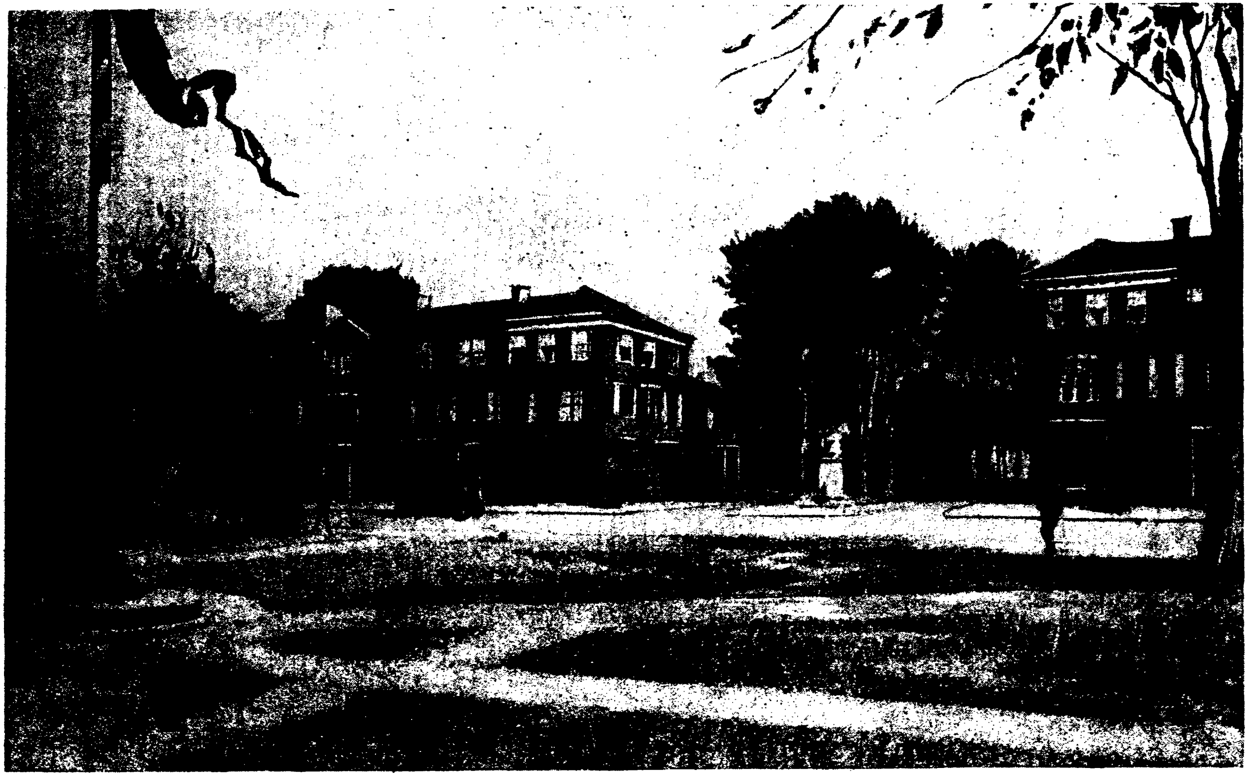


FIG. 184.—Design for Allendale Square, the business district of Yorkship Village.

The rent-paying ability of the poor is limited, and it is obvious that if they could be gotten onto cheaper land they might have more space and comforts. The cost of transportation back and forth to work is one reason for crowding into tenements, another is the social instinct which is strong among those who can have little purchasable amusement, the greatest is that in spite of the high value of the land on which they are built, tenements offer the cheapest places in which to live. Probably there will always be proprietors of small shops, lunch rooms, bakeries, laundries, cleaning establishments and similar businesses who will want to live in rooms above or behind their places of business since they, with the assistance of their families, do their own work. Where these enterprises are in the business district, the dwelling rooms connected with them will be more or less of the nature of tenements, but if these small shops are in small towns or in the suburbs the dwelling rooms may be well-planned larger apartments. To house the laborer in decent, healthful quarters and thus to take the first step towards doing away with the tenements, the town planner must provide cheap residence districts near the manufacturing district or within easy reach, at low cost for transportation if that is needed.

The better residence districts may be farther from the business part of the town and they may be on hill sides or hill tops, for the cost of street building and the laying of water mains and sewers on such sites is overbalanced by the value of the outlook, the better air, the privacy, and the cleanliness. Sites for churches and other public buildings which are desired should be arranged for in every town plan. In the case of schools, at least most of them should be in the residence districts rather than in business centres, however small the town.

Planning Streets.—Districting a city and providing for future growth of the various sections is far from being a simple matter, yet it is by no means as complicated as the planning of streets and parks. The street serves many purposes. First of all, it is a passage-way for pedestrians and for vehicles, trucks, limousines, bicycles and street cars. We do not often find all of these in nearly equal number on one street, some streets are more largely used by trucks, others by the pleasure car. The use which is to be made of the passage-way must be determined and the street built accordingly. The street is also a parking place for cars, and often the place from which goods are loaded and unloaded, so besides passageway it must provide standing room for vehicles. The street serves as a social centre in some places. Children use it as a playground, it forms an out-door living room for the tenements, people walk up and down the street meeting acquaintances and stopping to talk with them, it is a place where they may watch the world go by. Some streets made wide with a strip of parking down the centre serve as parks, and these street parks are used by far larger numbers than are the large parks on the outskirts of the city. Part of the street plan of a city are the centres or crossings where several streets converge, which are often the sites of monuments, or which are enlarged to form squares or small parks, or civic centres which add to the beauties of the city.

Streets do not receive their maximum use at all hours. The highways to and from the business districts are crowded morning and evening as men go to their work or return from it. The business streets are practically deserted in the evening except as used by theatre-goers. The boulevards and the parkways are most largely used in the evening, but all streets must be planned to accommodate the traffic of their busiest time and to accommodate emergency traffic, such as runs of the fire department.

The Main Streets.—(Fig. 185) The main streets of a great city must afford room for slowly and swiftly running vehicles going in opposite directions, for those which are at a standstill, for car lines and for foot passengers, or else there must be traffic regulations to keep heavy trucking on some streets, light cars on others, with provision for "one-way streets," parking places, subways and elevated lines. This specialization of streets which we find in cities with narrow streets may perhaps be better than very wide streets used for all purposes, but city planners are prone to favor the great highway subdivided to provide for all kinds of traffic and often to contain a strip of public garden as well. Business streets need heavy, durable paving, and the grades of business streets and great highways should be as easy as it is possible to make them. They should be straight, to make easy travelling, with any necessary change in direction a gradual one, and there should be flat curves where there are intersections with other streets in order to prevent accidents, which otherwise, with many swiftly moving cars, are likely to occur. Great highways should run toward the outlying districts, and converge toward the business centre, there breaking up into smaller streets. Streets which run north-east and south-west, and north-west and south-east give more sunlight to the buildings on them than do streets which run east and west and north and south. Where streets are narrow and buildings crowded closely together this matter is of more importance than where lots are large and houses may be placed upon them in any position. The distance apart of business streets where travel is heavy depends upon the lot sizes needed by the buildings in the neighborhood, and upon the width of the streets. The city dweller and more especially the country visitor to the city know the difficulty of negotiating the crossing of a busy street. The islands of safety which we find along the center of the boulevards of many cities are all that their name implies. These stepping stones across a street filled with swiftly moving cars give one a feeling of security and afford breathing places where the timid may recover courage for further adventure.

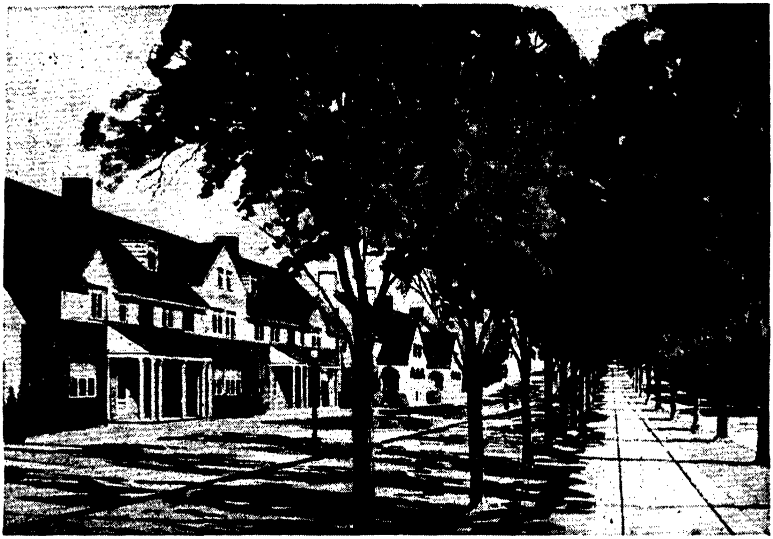


Fig. 185.—Wildwood Avenue, Sawyer Park, Williamsport, Pa., showing trolley line screened by trees and group houses of an industrial housing development.

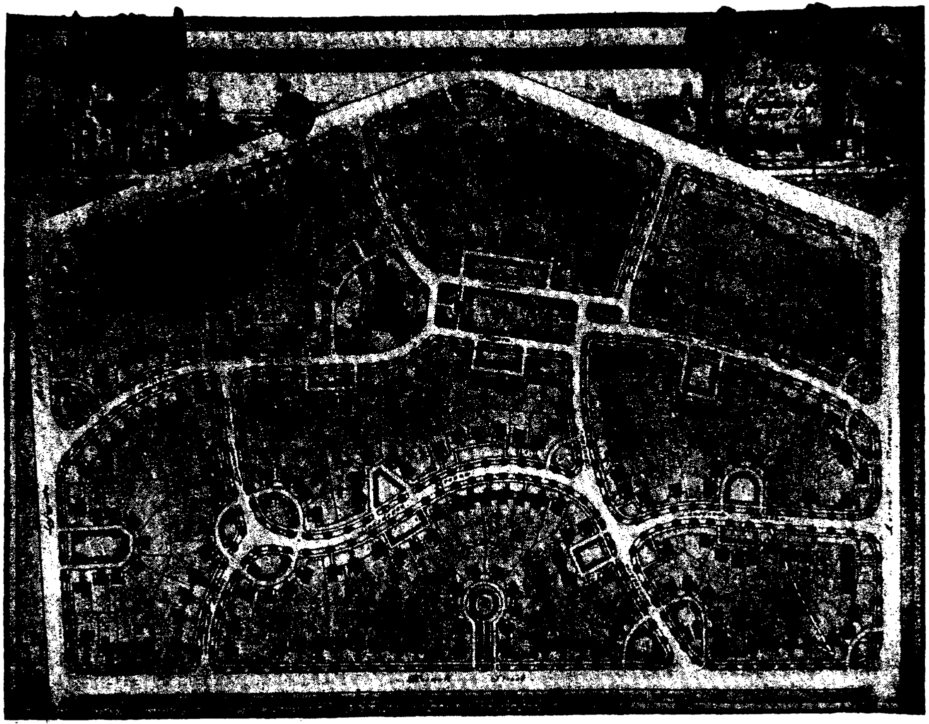
Residence Streets.—The streets of the residence districts are of two kinds, those which serve as thoroughfares, and those which are used by the immediate neighborhood only. The former, of course, are more or less like the business streets and may be continuations or branches of the main highways. Where the latter traverse residence sections the strip set apart for car tracks is often parked, and parking is used to separate the roadway from the sidewalks. These streets should be more or less like the business streets as to paving, grade, and direction. The other streets of the residence district are not much travelled, and need not be wide. If it seems probable that in the course of time a residence street will have to be widened, provision for this may be made by making deeper lots along this street and requiring that all buildings be put back a certain distance from the roadway, or the street may be wide with a narrow roadway and broad strips of parking between it and the foot-paths. Expensive roadways are not needed for this second kind of residence street because, except for moving-vans and coal wagons, only light delivery-trucks and pleasure cars will be used upon them, and these in small numbers. For the same reason it is not necessary that the grades of these streets be very easy, or that the streets be nearly straight; they may wind about as the natural contours of the site suggest without danger to those who use them. In a suburban district there is no reason why the sidewalks must follow the grade which the roadway does. If the streets must be cut into a hill side, a sidewalk at a higher level than the drive saves expense and makes the lots above the street better. A street on a hill side is perhaps best with lots on the upper side only, or it may be made a two-level street in order that the lots on the lower side may not be far below street grade. The distance apart of suburban streets depends upon the site and upon the size of the lots. While streets running in one general direction should be the distance apart of the depth of two lots, the cross streets may be further apart. Many cross streets mean waste land and too many expensive corner lots. Cross streets at greater distances apart than we commonly find them would not be a great inconvenience, none at all for persons in cars going from one street to another. For the use of pedestrians foot-paths might be made at more frequent intervals than the cross streets. The parking strip between roadway and sidewalk is a protection against mud and dust, any shrubbery in the parking should be low, otherwise approaching cars are not easily seen and there is danger of accident.

Plotting of Lots.—One matter which is inseparable from street plotting is lot size. In the better residence districts this is not of as great moment as it is in the cheaper districts where the lot cost must be kept as low as possible. A generally accepted standard is that there should be fifteen feet between separate houses, or that houses should be built in shallow rows two rooms deep, getting all the light and air from the front and rear. With fifteen feet between houses the lot for the small detached house should be thirty-five feet wide for the smallest houses. The lot depth is a more difficult matter to fix. Since the cost of street improvements is a large part of lot cost, shallow lots may be almost as expensive as deeper ones. The deeper lots are not always desired, a lawn or a garden requires a good deal of work for which often the working man has neither time, strength, nor inclination, and neglected back yards are the results. This is a problem to which the educational approach is evidently necessary in order to interest some families in the proper care of home surroundings. In some places shallow lots have been planned with the rears of the lots on parallel streets abutting on a strip of ground which in some blocks is used for gardens which are assigned to those who wish to cultivate them, in some blocks this strip is used for playgrounds, and in some for tennis courts. This arrangement means, of course, higher rents to pay for the upkeep of this strip of ground. It must also be remembered that gardens and tennis courts do not take the place of the busy street in the lives of those who need amusement as much as rest, for the street affords constant entertainment to those who watch the passing show. The problem of the housing of the unskilled wage-earner is an unsolved one, but its solution is bound up with city planning and the two questions must be considered together (Fig. 186).

After a little thought on the subject it seems obvious that all streets do not require to be of uniform width, to have the same kind of paving, to be the same distance apart and to run either parallel or perpendicular to each other or to be of standard grade, yet city ordinances require just these things, and the result is great unnecessary expense. It is extravagant to make streets unnecessarily wide in residence districts where there is little travel or to make a short residence street the same width as a long one, to pave them as the down-town streets which carry heavy traffic are paved, and to cut them down or make great fills to secure a uniform grade. Certainly a railroad needs as level a grade as possible, the manufacturing and business districts require the same, but in the residence districts, except on the main, much-travelled thoroughfares, such grades are not required, and irregular streets following the natural contours and slopes are not only cheaper but they give more picturesque effects, preserving the charm of winding ways, nevertheless there are cities which enforce this costly standardization of width, of paving and of grade, on all their subdivisions, as well as what is known as the rectangular or gridiron street plan, streets running at right angles to each other and at certain distances apart. The people who live on these streets pay for these extravagant and unnecessary improvements, and consequently are deprived of desirable things which their money might buy.

City planning does much to fix the character of the different districts, but as the town grows the streets receive greater use, and the use of some must necessarily change if it is only to take care of the greater amount of travel back and forth to the outlying districts, so, to promote economy, the street planner must have a prophetic knowledge of what the growth may be in order to plan the streets for their future as well as their immediate use.

Alleys.—Alleys have their advocates and their opponents among those who have studied street planning. The former claim that all disagreeable traffic such as that of delivery wagons and garbage wagons may be kept in the alleys, that the alley is an aid in ventilation and fire fighting and that alleys, as circumstances require, may be converted into streets. The latter argue that alleys are likely to be neglected and to become nuisances, that there is danger of rear houses being erected upon them, and that their cost, original and maintenance, is far too great. There is a tendency to concede the alley to the business district and to do away with it in residence districts. In the latter a right of way for poles and conduits is often reserved, but the owner of abutting property uses this strip as if it were his own except that he cannot build upon it.



From *Report of the Ontario Housing Committee*, H. B. and L. A. Dunington-Grubb, Landscape Architects.

Fig. 186.—Plan of the Garden Village of the Dominion Steel Products Company, Brantford, Ont.

Parks.—Parks must be arranged for in town planning. Rough bits of ground which it would be costly to develop as building sites and places where there is a fine view should be reserved for parks. If the town is on a river, or lake, or other piece of water, part of the land bordering thereon should be made into a park. After the natural park sites are plotted others should be laid out so that there may be parks for all. Frederick Law Olmstead says that the distance between parks should not be more than a quarter of a mile. The small park receives more intensive use than the large one, but we should not be satisfied with small parks scattered throughout the city. Every town should reserve a large area on its outskirts where part of it may be kept up in its original state, part may be used for golf courses and baseball grounds, part for botanical and zoölogical gardens, and part for camping grounds. Such a recreation center offers many educational advantages. Museums located in a large park have better light than in the city and their contents suffer less from smoke.

Consideration Regarding Land.—In planning a new town or for a town's future growth there are other items to be considered besides the town or city. These are the topography of the land, its present use, and its agricultural possibilities. A plan is made on paper but it must be carried out on the soil. Where there is some long established usage of a certain area there is likely to be opposition encountered when a change is proposed. In England a plan for the future growth of a certain place was rejected because land surrounding it used by market gardeners was assigned to parks and recreation centers and because the growth of the town was directed toward satellite villages. A second plan which left these gardens and villages untouched and placed the recreation grounds in a strip of waste land found favor. This was sound economics.

Garden Cities.—The "garden city movement" is an attractive name for the growing tendency to build new villages and suburbs according to the principles of town planning discussed above. In Europe and in America we have examples of beautiful, sanitary towns which exemplify these principles. In order to make the most of any town site, foresight, leadership and knowledge of city planning are necessary. In some cases, this is provided by the real estate company which puts a new addition on the market, sometimes by a corporation which provides dwellings, or sites for them, for its employees, and sometimes by a coöperative society. In late years, a few villages and cities have improved upon the usual ordinances pertaining to building and street plotting and have established boards of planning. Recently there has been considerable legislation in Europe and in America, the aim of which is the securing of better planned towns than those which have grown up in the past. In the United States this legislation has usually authorized, or, in some cases, made mandatory, town-planning commissions the members of which are appointed, serve without pay and have advisory powers only. As a rule, these commissions may employ an expert. With the growing interest there is in town planning and in housing improvement, more garden cities and suburbs may be expected to grow up in every section.

Planning in Existing Towns.—(Fig. 188) Town planning applies to old cities as well as to new ones, for in the course of years a city is gradually made over and when this remodelling is directed the old cities may become quite as modern as new ones, yet withal have something of quaintness, charm and historical interest which the new cities will lack until they, too, have become ancient. In Europe there is more town planning than in America. Paris has been almost completely made over, its good old buildings have been set free from the squalid shacks which surrounded them, and the streets so arranged that these buildings may be viewed from all angles. Great avenues have been cut to the centre of the city to admit air, streets have been widened, boulevards have been built where were formerly walls and fortifications and new buildings have been fitted into the scheme until Paris is to-day considered the most beautiful and up-to-date city in the world, while its history goes back to the days when it was a Roman military camp and remains of this old Paris are preserved in the heart of the modern city. All the great cities of Europe have been more or less modernized, at enormous costs. The same thing is true of our own large cities, millions of dollars have been expended yearly in building parks and widening streets, money which might have been saved if there had been a plan providing for growth.

Planning for the Future.—A city is never finished, it must be planned for expansion and with enough flexibility to meet changing conditions. For this reason there must be permanent

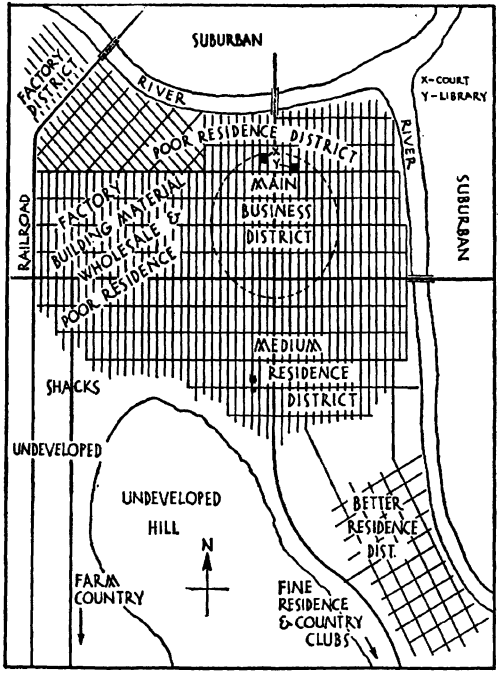


FIG. 187.—A small city which has grown without a plan. Slum areas have developed along the river front, originally the site of the best homes, and in territory adjoining the business district. The various areas are not as definitely separated as the boundary lines shown appear to indicate.

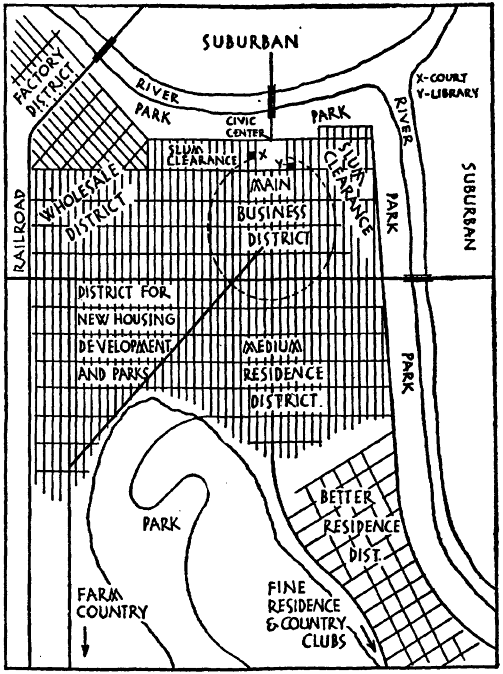


FIG. 188.—Plan for slum clearance and beautification of city shown in Fig. 187. The slum areas are to be cleared and to become the sites of large-scale housing developments and parks. A wide boulevard from the southwest will lead to the center of the city. Along it will be acreage plots for so-called subsistence homesteads. Eventually a civic center will be built to include the post-office and the courthouse.

authority, constantly on the watch to direct the city's growth in order that it may not interfere with the rights and interests of any one, and in order that the benefit of the growth of the city may be reaped by all. In the uncontrolled and undirected growth of most cities there is great economic waste. Prevision of this growth and provision for it will prevent much of such waste. Of course, we cannot foresee all the needs of cities one hundred years from now. We do not know what new things may modify them in that time. In the last hundred years railroads, rapid transit, telegraph and telephone, the growth of factories, the automobile, and last of all, the aeroplane, have made cities of towns, and forced upon them many radical changes to meet the rapidly changing conditions. In spite of the fact that we cannot foresee all of our needs, nor forestall all of the waste that changing conditions cause, some sort of a plan and studied direction of the expansion of our towns is far superior to haphazard growth. Zoning regulations, that is, different restrictions for different sections, are essential. Most cities have such regulations as to fire-proof con-

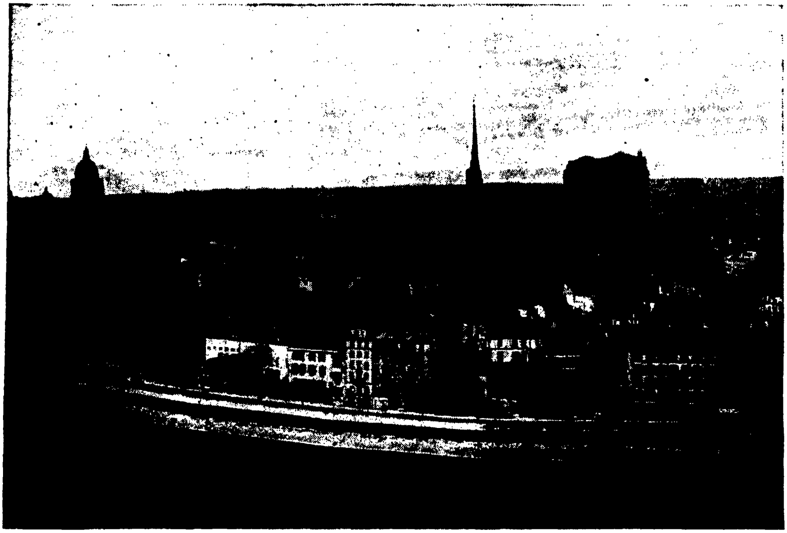


Fig. 189.—Paris and the Seine. Note the park behind Notre Dame, the boulevard along the river with the street at the left running into it affording a fine view of the Seine.

struction, height of buildings and sanitary provisions. Many cities are setting apart certain areas for industrial development, others for commercial enterprises and others for residence purposes and in time all cities and villages will follow this plan. Realizing that much of our work may be impermanent because of the natural growth of our towns and because of the growth of our ideals and the newer knowledge we may hope to have as to things which are essential to our well-being, we must avoid too much rigidity, and we should think twice before undertaking expensive works that are not absolutely needed.

PROBLEMS

1. Do you know any town or city which you especially like or dislike? Can you analyze the reason for this? Does it have any connection with town planning?
2. Do you know a town which has grown according to a predetermined plan? Compare it with one of equal size the growth of which has been haphazard.
3. What rules for plotting new additions would you advocate a city imposing upon real estate developers?
4. What size lot do you consider best for the average five- or six-room house? Why?
5. What is the chief business of your town? What conditions does this impose upon its plan?
6. What are the chief characteristics of the site of your town, and how should these influence its plan?
7. List the faults of arrangement of some city and any improvements which you would like to see made.
8. Make a plan of your town and on this show changes and rearrangements which might gradually be made of the different districts, streets and parks.

CHAPTER XXII

OWNING VERSUS RENTING

"Own your own home" is a slogan we often hear. "Why pay rent," you are asked, "and at the end of a term of years have nothing but a bundle of rent receipts when you might have a deed?" On the face of it this sounds convincing; why should you pay rent for a house indefinitely if for the same payments over a definite number of years you can purchase a comparable property?

Purchase Price Not the Whole Cost.—To answer this question intelligently several points must be considered. Taxes, insurance, repairs and assessments must be paid by the owner and these items must be added to the cost. Houses built to sell, those to which the above quoted argument is applied, are almost invariably cheaply built, they deteriorate quickly and require a great deal more in the way of repairs than do well-built houses. Houses built to sell are usually in new districts where very often there are still to be paid assessments for sewers, sidewalks and other improvements. In the more or less haphazard growth of our cities it is not easy to foretell what will be the fate of any particular residence district. Whether the lot will increase or decrease in value is problematical. The depreciation of the building is certain, though it be built in the very best fashion there will be some deterioration of some parts, and again, as ideas of arrangement, convenience and appearance change, the house will become of less value.

If one decides to own his own home it is best to study carefully the places for sale and if no satisfactory ready-built house is on the market, to build, rather than to buy a jerry-built house scamped in every part of it with the aim of making as great a profit as possible.

Borrowing Money to Buy a House.—Buying a ready-built house on the instalment plan is usually made easy for the purchaser by the seller, that is, the latter pilots the former through the intricacies and technicalities of borrowing money or takes a mortgage on the place himself. Often the person unversed in financial methods who wants a house does not realize that it is not necessary to have on hand a large sum of money with which to build, that it is as easy to borrow for building a house as for buying one already up. Customs relative to borrowing money differ in different localities. As a rule, the owner must have enough money to pay for his lot at least. He may secure money for the house by giving a mortgage on the property providing it offers to the mortgagee an attractive proposition. A loan secured by a good lot with a clear title in a desirable locality and plans and specifications for a well-arranged, well-built house with estimates for its cost or contractors' bids for it, the house to be insured for the term for which the money is desired, and with a rate of interest comparable with what may be secured from good bonds, is a good business proposition, one for which investors are looking. A loan thus to be secured may be obtained through bankers, agents for estates and brokers who usually charge a commission. The money is borrowed for a term of years, and the interest is usually payable quarterly or semi-annually. As a rule, not more than sixty per cent. of the total value of the house and lot may be borrowed unless the mortgage is to be amortized, that is, paid off by regular payments, usually made monthly, which gradually reduce the amount of money owed and increase the owner's equity in the property. Money borrowed from a Building and Loan Association is secured by an amortized mortgage.

Sometimes additional funds may be borrowed and security given in the form of a second mortgage. Since a first mortgage constitutes the first lien against the property a second mortgage is not as safe an investment as a first mortgage. Second mortgages are almost always amortized. In some places second mortgages may be taken by Building and Loan Associations, but as a rule the state laws do not permit this and money so secured must be obtained from other sources. Often the person or company selling the lot, or the builder, will take a second mortgage usually discounting the loan for a considerable amount to offset the riskiness of the transaction.

In some places Second Mortgage Companies have been organized to operate through Building and Loan Associations to aid the man who has only a small part of the purchase price of a house. The latter furnishes ten per cent. of the price, the Building and Loan Association perhaps as much as sixty-five per cent. and the Second Mortgage Company the remainder.

In another chapter are discussed some other sources from which money for home building may be obtained. In a few places some of these sources are already available, in other places they will probably be available in the future.

Danger in Buying on the Partial-payment Plan.—There are advantages and disadvantages about buying a house on the instalment plan. On the one hand it is an incentive to saving, on the other hand there is the danger of loss. Many houses have been bought or built on the partial-payment plan in a time of prosperity and when paid for in part have reverted to the men who held the mortgages when financial depression succeeded prosperity, or when misfortune overtook the purchasers. There is pleasure, not unmixed with anxiety, in owning, if only in part, one's home, making the garden, and building up the home in its permanent environment, on the other hand there is pleasure in anticipating the delights of householding and in building up ideals of the house one wishes, while one is accumulating the cash to pay for it, and in this latter case there is more likelihood of eventually securing a house which exactly suits one's needs.

Loss When Forced Sale Is Necessary.—Some people tell us that even if we have the money in the bank it is better to rent than to put it into a house. These are the days of big business. The great majority of men are salaried and most of them move from one neighborhood or one city to another in order to secure an increased salary. A forced sale of property usually means a sale at a loss. For this reason those who are likely to change their residence should not own their own homes unless they can afford to take this loss, unless they can afford to pay this added price for the privilege of being their own landlords. A coöperative home-owning society affords most of the advantages of individual ownership and enables any member to sell without loss if he must leave the city. We will probably have more of such societies as time goes on.

A House as an Investment.—Many people maintain that whether or not one must consider the possibility of removal to another town, it is cheaper to rent one's house than to own it. When one counts interest on the money invested in a house, taxes, repairs, and depreciation of value, the sum may in many instances equal or exceed the rental he would pay for a similar house. Even if the property increases in value it may be cheaper to rent than to buy, if the money that might have been invested in a house is invested in some other way. We are told that if the same amount of money as that with which Astor bought part of the site of New York City had been put in the savings bank at compound interest it would now have increased to a sum sufficiently large to buy back the land, together with all the improvements on it. Most of us, however, want to reap some of the profits of our savings ourselves instead of leaving them to pile up at compound interest for generations. For this reason we invest in business, and take the concomitant risks.

If a young man with a small capital could only be assured that by investing his money in some business he would increase it considerably he would certainly be justified in renting rather than in purchasing a house. In addition to the advantage gained in this way he would be free to change his residence if the neighborhood of his rented house should become undesirable or if his business should prove so prosperous he could afford a better house or neighborhood. But the majority of business ventures are failures and the young man's capital, if he goes into business, is likely to vanish into thin air and then he is left without capital and without house.

On the other hand, a house and lot, although they may depreciate, will always have a considerable value and will always afford a shelter. The neighborhood may become less desirable, but the house will still be a place which love and contentment can make very precious, and the family may have the pleasure of improving it and beautifying it, thus increasing its charm and its value.

Other Considerations.—A home large enough for the family requirements at the time of its maximum needs—that is from the time the children have outgrown babyhood and before they have begun to leave home—means a house larger than necessary for the young couple or for the family with one or two little children and is again larger than is required by the parents when the children have all left home. Only families with surplus means for the expenditure for unnecessary space during these periods of minimum needs can afford home ownership, for it is not always possible to sell to advantage an outgrown or a too large house and buy a suitable one.

Economists recommend that not more than one and one-half to two and one-half times the annual income be invested in the small home. The smaller the income, the lower should be the proportion of it invested in this form. It is generally considered that the lot should cost about one-fifth of the total cost of the house. The rent paid for a home should as a rule be less than twenty per cent. of the income, and except in cities it should not exceed sixteen or seventeen per cent. of the income. Economists state also that from two-fifths to two-thirds of the annual income is a reasonable investment in furnishings.

A man's business ability, or his own opinion of his ability, will usually be a determining factor in directing his choice between owning and renting. The nature of his occupation will be another. If he has already started in business or if he is established in a profession he may prefer to own his home, since it is probable that he will remain in the place where he has a start, but if he is not working for himself he may consider it best to be unfettered by the possession of a house in order that he may be free to move to a new neighborhood or to another city should a better position be offered him.

Home Not Dependent Upon Ownership.—It is a beautiful thing to own a house of one's very own, to accumulate adornments for it, to take root in a certain place and to know one's neighbors, yet no one need be dissatisfied because he must be a renter, for the renter has his own compensations. The occasional changes of residence broaden one and make life seem longer because they break its monotony. One finds that there are fine neighbors everywhere, and learns that home is not, after all, a house, but largely a state of mind, while after each move, when the sorting and discarding and packing are trials of the past, and the lares and penates are safely enshrined in the new domicile, he gathers his family about the freshly lighted fires and with them rejoices in the possession of a home.

CHAPTER XXIII

SUGGESTIONS TO TEACHERS AND STUDY GROUP LEADERS

Courses in Housing.—Some of our colleges already offer lectures on Housing Problems, quite apart from the House-planning course frequently offered by the department of Home Economics. The subject is one in which there is a growing interest. A well-rounded course in housing should treat the sociological and economic phases of the problem which are having the attention of every thoughtful city planner, social worker, labor leader and sanitarian, and should also include the more intimate and personal phases of the problem usually presented in Home Economics courses. Such housing courses are already in the process of development in departments of sociology and social work and in college and high school Home Economics departments and there are many indications of a growing demand for persons having extensive and expert knowledge of housing and the housing problem.

The study of shelter is one of the divisions of the larger subject named Home Economics. Its aim is to establish standards and ideals for proper housing. These standards and ideals are not fixed, they are constantly being raised. Home Economics stands sponsor for home improvement for all people and a satisfactory course in the house must include phases of the housing problem remote from the student's individual experience. Because of the relation between the home and the house, and because of the relation between shelter and other phases of Home Economics, the study of the house is a basic one in the field of Home Economics.

Housing must be made a part of the Home Economics program as important in its place as are Food, Clothing and Management. This can be done by teachers of these subjects introducing house projects into their courses; it will be done ultimately, in higher institutions at least, by independent courses in housing. This book is intended to serve in either type of instruction.

Methods for College Students.—Secondary and college Home Economics training should be vocational training either for home-making or for some one of the other vocations for which one may prepare in college Home Economics departments, yet much of the curriculum must be non-vocational. This book may be used in a vocational or non-vocational way. Its subject matter will be approached by some specializing students in a truly vocational or professional way; at the same time it presents problems of which every cultured person should have some knowledge and of which every person trained in Home Economics should have a great deal of knowledge. College students will often use this text in a specialized course offered by one or another department. The subjects treated may, if desired, be taken up in an order different from that in which they are given, for many of the chapters are independent of the preceding ones. Good teachers will have their own methods of work and will adapt the material to the needs of the class and to the time which is at their disposal. College teachers will find further suggestions in the more detailed points offered below for the high school teacher and for the club leader.

Suggestions for High School Teachers and Club Leaders.—All high school pupils and many study groups should use the text in connection with house-keeping and home-making projects in food, management, hygiene, and other courses whether or not there be an isolated course on the house. House-keeping and home-making are both dependent upon the house in which they are practised, and in secondary schools this close connection should be repeated in the teaching of the different phases of Home Economics. This work should include study of houses of different types, those better and those poorer than the ones the pupils live in. In connection with the preparation of food the kitchen and food storage should be considered as to convenience, comfort, sanitation and appearance. As part of the study of table service, the dining room should be studied, and as part of the study of the social life of the home, the whole living part of the house. Study of the bedrooms, of heating, lighting, ventilation, and location should be tied up with lessons in hygiene and care of the sick, the laundry and basement may be studied in this connection or with laundry work. Similarly, other chapters of this book will correlate with various topics of different courses.

There are many matters dealt with in Home Economics work in which men and boys are as directly interested, and for which they are as responsible, as women and girls. It is to be hoped that house projects along these lines will be open to boys as well as girls. The problem of shelter, and something of town planning, would come in together with budget making, in the high school courses in Economics. Exterior and interior house design will be phases of any art course in which the principles of design are presented and then applied with regard to the art experiences of the average person. These subjects, together with the design of the home grounds, or, as it is often called, "home beautification," represent an art area in which every family has a chance for self-expression, hence its great educational importance. In civics, the matters of legal regulation of housing, town planning, zoning, and the like, should be included as important topics. It is not necessary in secondary schools to use the whole text if some part of it does not have a direct bearing on the work in hand; still, most of the topics will fit into any curriculum and are connected with some appropriate home project.

The book yields itself to modern project teaching. A project in any subject should have the following characteristics:

(1) An explicit purpose, the value of which will be evident to the pupil.

(2) Work to be done.

(3) Demand upon the pupil for one or more of the following:

(*a*) Initiative	(*d*) Discernment
(*b*) Responsibility	(*e*) Analysis
(*c*) Persistence	(*f*) Synthesis

(4) Connection with school and with life. Preparation and direction to come from the school, the world outside of school to furnish the urge, the laboratory, and the data.

(5) Specific results and measurable outcome in terms of time, money, health, comfort, security, cheer, elegance.

Housing Projects.—There are many distinct housing projects suitable for high school students, boys as well as girls. A few of these are listed below.

Projects.—The problem of planning an inexpensive house, from the selection of the lot to the design of the interior features, would not be too difficult. Such a project is outlined by the starred problems given at the end of the chapters.

The planning of a summer camp for an organization such as the Boy Scouts or Camp Fire Girls. This would be more simple than the above, and could often be made practical by coöperation with a local organization.

A town-planning project taking in part or all of the local community would be well worth while; it might start an interest that would lead up to official replanning of the home town.

To make a house score card for all those points which can be judged from the outside and to use this in scoring houses in different parts of the city. A score card for all the points upon which to judge the house might be made and used similarly for vacant houses.

To list the best features in the houses of ten or more friends and determine how many of these might be incorporated in a new house.

To replan the working rooms and equipment of one's own house.

To plan the finishing of an unfinished attic to provide one or more of the following: A girl's or a boy's bedroom, a studio or a workshop, a playroom. The actual work of finishing the attic might be done by either a girl or a boy.

To find out what legal requirements apply to housing in one's own locality and to list violations of these.

To offer suggestions as to how these laws might be better enforced. To add further regulations which conditions seem to call for.

Other Projects.—In order to give some idea as to the scope of projects connected with the house yet not distinctly housing projects, which are suitable for students, the following suggestions are given for a few projects in which the house or some aspect of it should be stressed, and one of them is briefly outlined to illustrate the relation between the house and the life and work within its walls.

Home-making Projects, Involving a Housing Factor

To have the care for one week of:
  - (*a.*) Bedrooms.
  - (*b.*) Living rooms.
  - (*c.*) Bathroom.

To prepare for a certain length of time:
  - (*a.*) Breakfasts.
  - (*b.*) Bread.
  - (c.) Young child's meals.

To plan and act as hostess for:
  - (*a.*) A meal.
  - (*b.*) A reception.
  - (*c.*) A garden party.

To act as waitress for one week for one meal a day.

To assist with laundry for one month.

To make a family budget for one year.

To improve and care for the home grounds for one year.

To care for the furnace for one month.

Project Outline: To Care for Bedrooms for One Week

Preparation:
  - Study of Hygiene and Sanitation with summary of points applying to sleeping quarters.
  - Analysis of uses of bedrooms and listing of furnishings required.
  - Study of care of floor and furnishings.
  - Study of bedrooms by visits and pictures.
  - Study of floors, windows, doors, closets, light, and heat of bedrooms.

Plan for work:
  - What to do.
  - Time for it.
  - Method.
  - Securing of permission and interest of mother.

Work:
  - Follow plan.

Keep notes for report.

Report:

- Time required for care.
- Equipment required for care. Storage of such equipment.
- Changes in arangement of furniture and reasons.
- Changes in plan which would be desirable, and reasons:
    - (*a.*) Individual rooms.
    - (*b.*) Bedrooms as a group.
- Comments by members of family.
- Difficulties encountered.
- Remedies applied and possible.
- General rules for:
    - Use by occupants.
    - Daily and weekly work.
    - Planning.
    - Furnishing.

Club Projects.—Projects eminently suitable for men and women, college students or the members of a woman's club or a man's club such as the local Chamber of Commerce Rotary Club are the following:

To study budgets and standards and costs of housing in relation to family living.

To study housing conditions in the community:

- (*a.*) A survey of working family housing.
- (*b.*) Comparative study of moderate income housing.
- (*c.*) Charting and mapping the housing conditions of the community.

To study the relation of the house lived in to:

- (*a.*) Parts of a possible city plan; business district, residence district, parks, etc.
- (*b.*) Desirable zoning restrictions.
- (*c.*) A housing code.

To improve homes by:

- (*a.*) Better sanitary arrangements.
- (*b.*) Addition of conveniences.
- (*c.*) Better arrangement of kitchens.
- (*d.*) Beautifying houses.

To strengthen the hold of the home upon young people.

To conduct a local housing betterment campaign.

To establish a permanent volunteer agency for enforcing housings laws.

From six to ten meetings, or a year's work, might easily be given to each of these projects, some phase of the problem being assigned for each meeting and a different club member appointed to plan the program for each. Physicians, architects, welfare workers, Home Economics specialists, and other persons interested should be asked to talk upon suggested subjects, and after each of these talks different club members should volunteer to continue the study along the lines laid down by the leader and to report on these at future meetings. Such a local study should if possible lead to a definite constructive movement for better housing.

Illustrative Material.—Pictures and drawings will be found of great value for any class studying the house. Photographs, prints, and picture postcards may be purchased, pictures cut from magazines or advertising booklets, and these mounted for a permanent collection. Other pictures will be found in books. The projectoscope is useful for pictures not available as lantern slides. Slides and moving picture films are of great value in teaching this subject and these may be purchased or rented and in some cases may be had for nothing. The U. S. Department of Agriculture has a collection of slides which may be borrowed, many State Universities and Agricultural Colleges have collections which they lend, as do some private colleges. Slides and films may be borrowed from the American Institute of Architects, Octagon Square, Washington, D. C., and a few commercial firms. The U. S. Housing Bureau, under the U. S. Department of Commerce, and the Educational Motion Picture Bureau, New York City, have pictures which may be borrowed.

Catalogues, U. S. Government bulletins, bulletins from the state colleges and booklets issued by many firms and associations make useful additions to the reference library. The National Housing Association, 105 East Twenty-second Street, New York, is the source of information on housing reform and legislation.

The making of individual scrap books is also an aid in studying the house. These might contain notes as well as pictures and should follow some orderly plan.

Trips around town and to neighboring places offer splendid opportunities for finding concrete illustrations for almost any part of this work.

Samples of building materials, small models showing construction and charts are useful illustrative material to collect or to make and to have on hand. In the advertising pages of magazines devoted to the house, many advertisements of free booklets and samples may be found.

Drawing Equipment.—Drawing boards, T-squares, triangles, scales and drawing instruments are necessary for the best work in planning and design, but if these cannot be had, good work in planning may be done on squared paper. For making elevations, tracing paper may be fastened over the squared paper and when the drawings are finished they may be mounted on plain paper.

General Suggestions.—The method of presentation of this work must vary with the class, but for all groups, class discussions of the ideas suggested by the text, by illustrative material and by problems brought to the class by its members will be found very helpful. The problems suggested at the end of each chapter may be added to, or amended or omitted, as seems best. When the students have the requisite skill, plans may be made for a house, or any part of it. Whenever it is possible to do so, it is advisable to take as a problem the planning or remodelling of a house which is really to be built or altered, and in studying the larger aspects of the housing problem to take examples and problems from the immediate neighborhood. In the same way, a critical constructive study of the whole local community from all its aspects related to housing—city plan, building laws, districting, building trades, building materials, financing of housing, and other problems—can be made most helpful. It is well to have the students of this subject work out practical problems and to have them visit buildings as much as possible, for mere study of the text without this laboratory work will lose half its value.

APPENDICES

REFERENCES FOR FURTHER STUDY

I. BOOKS

A. GENERAL

Bemis and Burchard. *The History of the Home.* The Technology Press. Vol. I: *The Evolving House,* 1933. Vol. II: *Economics of Shelter,* 1934. Vol. III: not yet published.

Halbert, B.—Editor. *Better Homes Manual.* University of Chicago Press. 1931.

Halstead, F. *Architects' and Builders' Reference Book.* John Wiley & Sons. 1927.

Reports of Committees. *President's Conference on Home Building and Home Ownership.* 1932.

B. HISTORICAL STYLES AND THE CONVENTIONAL HOUSE

Eberlein, H. D. *The Architecture of Colonial America.* Little, Brown and Co. 1925.

Fletcher, B. *A History of Architecture on the Comparative Method.* Charles Scribner's Sons. 1924.

Hammond, J. M. *Colonial Mansions of Maryland and Delaware.* J. B. Lippincott Co. 1914.

Hannaford and Edwards. *Spanish Colonial Adobe Architecture of California,* 1800-1850. Architectural Book Publishing Co., Inc. 1931.

James and Yerbury. *Small Houses for the Community.* Crosby Lockwood and Son. 1924.

Murtagh, Gilbert. *Small Houses.* Doubleday, Page & Co. 1924.

Patterson, A. O. *American Homes of Today.* The Macmillan Co. 1924.

Phillips, R. R. *Small Family Houses.* Charles Scribner's Sons. 1924.

Price, C. M. *The Practical Book of Architecture.* J. B. Lippincott Co. 1916.

Sexton, R. W. *Camps in the Woods.* Architectural Book Publishing Co., Inc. 1931.

Simpson, F. M. *A History of Architectural Development.* Longmans, Green and Co. Three Volumes, 1905-1911.

Tallmadge, T. E. *The Story of England's Architecture.* W. W. Norton & Co. 1934.

Tallmadge, T. E. *American Country Homes of Today.* Architectural Book Publishing Co., Inc. New volumes issued from time to time.

C. THE NEW ARCHITECTURE

Chappy, Marcel. *Architecture Internationale.* Vincent Freal et Cie. First Series, 1929; Second Series, 1930.

Cheney, Sheldon. *The New World Architecture.* Longmans, Green and Co. 1930.

Gantner, Joseph—Editor. *Neues Bauen in der Weldt.* Band I: *Russland.* Band II: *Amerika.* Band III: *Frankreich.* Julius Hoffman. 1927.

Hitchcock and Johnson. *The International Style Architecture Since* 1922. W. W. Norton & Co., Inc. 1932.

*Le Corbusier. *Towards a New Architecture.* Payson and Clark, Ltd. 1927.

Neutra, R. J. *Wie Baut America.* Payson and Clark, Ltd. 1927.

Sexton, R. W. *The Logic of Modern Architecture.* Architectural Book Publishing Co., Inc. 1929.

Wijerveld, H. Th. *The Life Work of the American Architect, Frank Lloyd Wright.* C. A. Mees. 1925.

Yerbury, F. R. *Modern Dutch Buildings.* Ernest Benn, Ltd. 1931.

D. GARDENS

Bottomley, M. E. *The Design of Small Properties.* The Macmillan Co. 1926.

Eaton, W. P. *Everybody's Garden.* Alfred A. Knopf, Inc. 1932.

Phillips, M. E. *The Perennial Garden.* McDonald Publishing Co. 1934.

Ramsey, L. W. *Landscaping the Home Grounds.* The Macmillan Co. 1930.

Rehman, E. *Garden Making.* Houghton Mifflin Co. 1926.

---

* Pseudonym of C. E. Jeanneret.

Rockwell, F. F. *Lawns.* The Macmillan Co. 1929.

Steele, F. *Design in the Little Garden.* Atlantic Monthly Press. 1924.

E. HOUSING AND TOWN PLANNING

Adams, T. *Recent Advances in Town Planning.* The Macmillan Co. 1932.

Aldridge, H. R. *The National Housing Manual.* National Housing and Town Planning Council. London, 1923.

Barns, H. *The Slum, Its Story and Solution.* P. S. King and Son, Ltd. 1931.

Hubbard and Hubbard. *Our Cities Today and Tomorrow.* Harvard University Press. 1929.

Jeanneret, C. E. *The City of Tomorrow.* Harcourt, Brace and Co. 1929.

Lanchester, H. V. *The Art of Town Planning.* Charles Scribner's Sons. 1925.

Nolen, John. *New Towns for Old.* Marshall Jones Co. 1927.

Pink, L. H. *The New Day in Housing.* The John Day Co. 1928.

Purdon, C. B. *The Building of Satellite Towns.* J. M. Dent and Sons, Ltd. 1925.

Sayle, A. *The Houses of the Workers.* T. Fisher Unwin, Ltd. 1924.

Simon, E. D. *How to Abolish the Slum.* Longmans, Green and Co. 1929.

Townroe, B. S. *The Slum Problem.* Longmans, Green and Co. 1928.

Wood, E. E. *Housing Progress in Western Europe.* E. P. Dutton and Co. 1923.

Wood, E. E. *Recent Trends in American Housing.* The Macmillan Co. 1931.

II. JOURNALS

The American Architect
The American City
The Architect and Engineer
The Architectural Forum
The Architectural Record
The Architectural Review (British)
Architecture
California Arts and Architecture

City Planning
Garden Chronicles of America
Garden Design (British)
House and Garden
Housing
Innen Dekoration
Journal of the Town Planning Institute (British)
Landscape Architecture
Mobilier et Decoration
Town and Country Planning (British)
The Town Planning Review (British)

GLOSSARY

A

Abacus. The uppermost division of the capital of a column.

Acropolis. The citadel of a Greek city.

Aisle. One of the side divisions of a church divided longitudinally by rows of columns or piers. The central space is the nave, the spaces on either side, aisles.

Amortize. To extinguish a debt by periodic payments.

Anthemion. A flat ornament consisting of foliated forms arranged in a radiating cluster.

Apse. The end of a church opposite the entrance, usually semicircular in plan.

Aqueduct. An artificial channel for carrying a large quantity of water.

Arch. The structure, usually made up of wedge-shaped blocks with their joints radiating from a common centre, over an opening in a wall. The arch may be flat, round, pointed or other shapes.

Architrave. The lowest division of the entablature. Above it comes the frieze and then the cornice.

Archivolt. The architectural member composed of mouldings and flat surfaces surrounding a curved opening.

Area. A sunken space before a basement door or window to give entrance or light to the basement.

Articulated house plan. A plan with wings in which each type of room is in a separate wing.

Atrium. The open court before a basilica.

B

B. t. u. British thermal unit, the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

Baluster. An upright support of the rail of a balustrade.

Balustrade. The balusters and rail forming a protection on the open side of a balcony or other part of a house.

Band. A flat member, usually horizontal, dividing or ornamenting a wall, column or other part of a building.

Baroque. A style of design or decoration characteristic of the decline of the Renaissance.

Barrel vault. A semi-cylindrical vault.

Base. The lower part of a column made up of mouldings and a square plinth.

Baseboard. The protecting line of board carried around walls next to the floor.

Basilica. An early Christian church building, consisting of nave, aisles, a projecting semi-circular apse and a vestibule.

Bead. A small, projected rounding moulding.

Bearing surface. The surface over which a weight is distributed.

Belfry. A bell tower.

Billet. An ornament used for mouldings which resembles a billet (a round stick of wood).

Bond. The union of the bricks or stones forming a wall.

Buttress. A structure projecting from a wall, reënforcing it and receiving lateral pressure acting at the point where it is built. The flying buttress is a segment of an arch and the pier on which it rests, a device for carrying a thrust from a vault across an aisle or other open space.

C

Capital. The uppermost member of a column.

Casement. A window sash opening on hinges.

Cella. The part of the Greek temple within its walls.

Chef d'oeuvre. A masterpiece.

Chimney breast. The projection of a chimney from the wall in which it is built.

Choragic monument. A small commemorative shrine built by a successful choragus, that is, a chorus leader who provided dramatic choruses at Athens.

Clapboard. A narrow board, thicker on one edge than the other, used one overlapping another below it to form the outside finish of the walls of a frame building.

Cleat. A piece of wood or metal fastened to something to act as a support.

Colonnaded. Provided with a row of columns placed at regular intervals.

Column. A supporting pillar, circular in section.

Engaged column, a column not free, but attached to a wall.

Campagna. The country, the environs of Rome.

Composite. See order.

Conduit. An artificial passage for conveying water or carrying wires.

Corinthian. See order.

Cornice. The uppermost division of the entablature. The crowning member of a façade.

Cross-hatching. A marking of parallel oblique lines.

D

Dentil. One of the small, rectangular blocks of a series like teeth used in the cornices of the Ionic, Corinthian and Composite orders and in other places.

Direct heating. The system of warming a room by heating the air in it.

Dolphin. A fish abundant in the Mediterranean and used as a motif in Roman ornament.

Dome. A roof, any vertical section of which is a curve symmetrical about a perpendicular line dropped from the centre of the roof.

Doric. See order.

Dormer. A window projecting from a sloping roof, and the gable in which it is contained.

Drainage tile. Tile used in a drainage system for conveying and disposing of waste water.

Drain cock. A valve opened by hand to let the water out of a plumbing system or any part of it.

Duomo. Italian for dome and a name applied to the Italian cathedrals.

E

Eave. The projecting overhang of a roof or the lower border of a roof.

Egg and dart. An ornament of alternating egg and dart forms.

Elevation. In drawing the geometrical projection of a building or object on a plane perpendicular to the horizon; a term also applied to the façade of a building.

Engaged column. See column.

Entablature. The architecturally treated wall resting upon the capitals of columns and supporting the pediment or the roof.

Etruscan. See order.

F

Façade. An outer wall of a building which is treated architecturally.

Festoon. Anything used as a decoration and hung in a curve.

Fillet. A narrow, flat moulding.

Finial. Any ornament that forms the upper extremity of a pinnacle, gable or similar projection.

Flamboyant. Characterized by waving, flame-like curves. Applied to Gothic architecture, it is a style characterized by lines of double and extreme curves.

Flue. The passage in the chimney for conveying flame and smoke to the outer air.

Flue lining. A fire-proof material used to line the flue to prevent fire.

Fluting. A groove of curved section usually vertical and used in columns or pilasters.

Flying buttress. See buttress.

Foliated. Resembling a leaf or leaves.

Footing. A course or series of courses of masonry or concrete used under a wall or support and projecting beyond it to distribute the weight over a larger area.

Frame. The skeleton of a structure; the open case for a window or door; frame-house, one in which the supports are of timber and the finish is of wood.

Fret. An ornament of interlacing lines.

Frieze. The central part of an entablature between the architrave and the cornice. Any prominent ornamented band on a wall.

Furring. Thin strips or blocks of wood, brick or metal applied to a surface for the purpose of fastening other material to that surface. This is done to leave an air space, to make a wall look thicker than it is, to level up an uneven surface and for other reasons.

G

Gable. The vertical, triangular portion of the end of a building between the ridge pole and the line of the eaves of the roof on either side.

Gargoyle. A grotesquely carved water-spout projecting out from a building.

Girder. A horizontal member, either a single piece of timber, steel or other material, or a piece built up of beams, plates, etc., which is used to span an opening and carry a weight.

Girt. A horizontal band; the timber encircling the frame of a house at the ceiling line and carrying the joists of the floor above.

Glazed. Provided with glass.

Gothic. One of the chief styles of architecture, developed during the Middle Ages.

Grade. The upper surface of a road-bed or a building lot; the rate of ascent of a roadway.

Grade line. The line on a building to which the surrounding soil reaches, or is to reach.

Groin. The projecting solid angle formed by the intersection of two vaults.

Groined vault. An arched covering formed by the intersection of a vault running in one direction with one or more other vaults running in other directions.

Grotesque. An extravagant, fantastic combination of floral, animal and human forms.

H

Half-timbered. Constructed of a timbered frame with the spaces between filled with masonry or plaster.

Header. A brick laid with the smallest surface in the face of the wall. A timber framing an opening in floor joists; the header is fastened to two joists which form the sides of the opening perpendicular to the header, and other joists abut upon the header.

Head-room. A height sufficient to allow the average person to walk below a ceiling at this height.

Heating coils. The pipes carried back and forth in a fire box and through which water passes to be heated.

I

Indirect heating. The system of warming a room by conducting to it air which has been warmed in another place.

Ionic. See order.

Island of safety. Small elevated areas of pavement in the centre of a street.

J

Jamb. An upright surface bounding an opening.

Joist. A small beam of wood or other material running from wall to wall or between beams and which carries the flooring or ceiling.

K

Keystone. The stone or brick in the centre of an arch.

L

Lintel. A horizontal member spanning an opening and carrying a weight.

Lunette. The vertical surface of a wall framed by an arch.

M

Marl. Soil which is a mixture of clay and lime.

Masonry. That which is constructed of stone or brick.

Masque. A disguising cover or partial cover for the face; used as a motif in ornament.

Metope. The space between two triglyphs in the Doric frieze (see order).

Millwork. Finishing woodwork, the product of a mill.

Moated. Provided with a moat; a ditch to be filled with water around a fortified place.

Mold (Mould). A molding or a group of mouldings.

Molding (Moulding). A flat or curved narrow surface either sunken or projecting, used for decoration.

Monolithic. Of one stone, or of one mass of concrete.

Mortise. A cavity into which fits a correspondingly shaped projection, the tenon, used for making a joint, in woodwork.

Mosaic. A surface decoration made of small pieces of stone, glass or other material set together to form patterns.

N

Nave. The central space between the rows of columns which divided a church into nave and aisles (see aisle). The nave usually rises higher than the flanking aisles and has windows on either side above the roof of the aisle.

Niche. A recess within the thickness of a wall.

O

Order. A type of column and entablature, the unit of a style, of classical architecture. The Greeks used three orders, the Doric, Ionic, and Corinthian. The Romans added to these the Tuscan and the Composite. (See Webster's New International Dictionary for drawings and names of the different parts of the orders).

P

Pantheon. A temple dedicated to all the gods. The Pantheon, the temple in Rome dedicated to all the gods, now a Christian church.

Paros. An island in the Ægean Sea noted for its beautiful marble.

Parthenon. The Doric temple on the Acropolis at Athens dedicated to the goddess Athena.

Pedestal. The structure upon which the Romans, as a rule, set each of their columns. It consists of three parts, a molded base, a dado, and a mold at the top.

Pediment. The triangular space between the entablature and the line of the roof on either side from the ridge pole to the eave line.

Pentelicus. A mountain near Athens from which beautiful marble was quarried.

Pergola. An arbor treated architecturally.

Perspective drawing. A drawing of an object or objects as it or they appear to the eye.

Pier. A support for an arch or lintel, usually applied to massive supports, not columns or posts.

Pilaster. An upright support, rectangular in plan, projecting from a wall and treated architecturally with base, shaft and capital.

Pillar. A slender, vertical support.

Pinnacle. An upright architectural member, usually terminating in a small, sharp spire, much used in Gothic architecture.

Pitch. Degree of slope, or slope; the ratio of the height to the span of a roof or an arch.

Plate. A horizontal timber or piece of metal, laid on a wall or other support to carry the roof timbers.

Portico. A roofed-over colonnaded porch at the entrance of a building.

Propylæa. The entrance to the Acropolis at Athens.

Prototype. The original form after which something is copied.

R

Rafter. One of the sloping timbers of a roof.

Rayonnant. Sending out rays.

Rayonnant applied to Gothic architecture, characterized by radiating lines.

Renaissance. New birth or revival.

Renaissance. The period of the revival of letters and arts, beginning in the fourteenth century.

Renaissance architecture. The style developed during this period and based on a study of classic architecture.

Ridge-pole. The horizontal timber at the top of a roof receiving the upper ends of the rafters.

Riser. The space between two treads; the upright part of a step.

Rococo. A florid style of design or ornamentation.

Romanesque. A style of architecture somewhat resembling the Roman from which it was derived at the end of the Dark Ages.

Rosette. A small ornament somewhat resembling a rose.

Rose window. A circular window filled with tracery.

Run of stairs. A flight of stairs; the steps in one series unbroken by turns or landings.

S

Sash. The framing in which is set the glass of a window.

Scale. Relative dimensions.

Scroll. An ornament resembling a loosely rolled strip of paper.

Scullery. A room where the roughest part of kitchen work is done.

Section. The surface appearing when an object is cut through by an intersecting plane.

Septic tank. A tank in which sewage is temporarily kept to effect disintegration of organic matter by bacteria.

Shaft. That part of a column or pilaster between the base and the capital.

Sheathing. The covering on the outside of the studs to which is fastened the outside finish.

Siding. The covering of finished lumber on the outside wall of a frame house.

Sill. The bottom; the timber on which the studs rest; the lower piece of a window frame.

Skirting. Baseboard.

Sludge. The settlings in the septic tank.

Soil pipe. The pipe which carries waste from the water-closet.

Span. The distance between two limits.

The span of an arch. The distance it covers from springing post to springing post.

Spire. A very steeply tapering roof of pyramidal construction surmounting a tower.

Splayed. Flaring.

Stairrail. The rail, supported by balusters, around a stair opening or along a run of stairs.

Stack. A number of flues carried up in one chimney; or, in plumbing, a number of pipes carried up together, or the vertical pipe for waste into which waste pipes from the different fixtures empty.

Stop-cock. A valve to be turned by hand to permit or stop the flow of liquid or gas.

Stretcher. A brick, laid with the long side exposed on the surface of a wall.

Stucco. A fine plaster used as a coating for walls.

Stud. One of the upright pieces in the frame of a house forming the skeleton of the walls.

Studding. The studs in a wall; the material for studs.

Stylobate. The continuous flat pavement on which a row of columns rests.

Tenon. See mortise.

Thrust. The force with which one part of a structure pushes horizontally or diagonally on another.

Tiered. Composed of rows one above the other.

Tracery. Ornamental work of branching spreading lines; the open-work in a Gothic window.

Transept. The transverse part of a church crossing the nave at right angles between the entrance and the apse. Sometimes the transept projects beyond the aisles; sometimes there is no projection. Either arm of the transept is called a transept.

Trap. A bend or other device in a pipe to catch and hold water.

Tread. That part of a stair step which is trod upon.

Triglyph. The ornament in the Doric frieze which consists of three vertical plane surfaces separated from each other by V-shaped channels and from the frieze by half channels; below the frieze in the architrave continuing the triglyph are the guttæ.

Trim. The interior woodwork of a house.

Truss. Structural members such as beams and rods fastened together to form a rigid framework used to span a large opening.

V

Vault. An arched structure roofing over a space. The barrel vault is semi-cylindrical; there are pointed vaults and vaults of complicated outline. See dictionary for illustrations.

Volute. A spiral scroll-shaped ornament.

W

Waterleaf. A certain band ornament repeating a leaf form, especially resembling an ivy leaf.

Wave. An ornament repeating a form resembling a wave curling over upon itself.

Well-hole. The open space in a floor over a stairway.

Winder. A step in a stairway which makes an angle with other steps.

Window box or window frame. The frame which holds the sashes or casement of a window.

Z

Zoning. The restricting of certain areas of a town or city as to height of buildings erected, maximum proportion of area of lots to be occupied by buildings, character of buildings and nature of occupations permitted and so forth.

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